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MATHEMATICS.—*Note concerning the number of directions which, in a given motion, suffer no instantaneous rotation.* J. L. ERICKSEN, Naval Research Laboratory.

Let v^i denote[1] the velocity vector associated with a motion in a three-dimensional Euclidean space. In order that the element of arc in the direction of the unit vector λ^i be suffering no instantaneous rotation, it is necessary and sufficient that there exist a real scalar k such that

$$(v^i{}_{,j} - k\delta^i{}_j)\lambda^j = 0. \tag{1}$$

Thus k must be a real root of the cubic

$$\det\,(v^i{}_{,j} - k\delta^i{}_j) = 0.$$

Truesdell[2] calculated the discriminant D of this cubic, obtaining

$$D = -18IKL - 4I^3L + I^2K^2 - 4K^3 - 27L^2,$$

where

$$I = v^i{}_{,i}\,,\ K = \tfrac{1}{2}\delta^{ij}{}_{kl}v^k{}_{,i}v^l{}_{,j} = \tfrac{1}{2}[I^2 - v^j{}_{,i}v^i{}_{,j}],$$
$$L = \det v^i{}_{,j}.$$

He then concluded that the number of distinct directions suffering no instantaneous rotation is determined by the sign of D and that

(a) If $D > 0$ there are exactly three such directions.
(b) If $D < 0$ there is exactly one such direction.
(c) If $D = 0$ there may be one, two, three or an infinite number of such directions.

He remarks that it is difficult to obtain other kinematical interpretations for the conditions $D > 0$, $D = 0$, $D < 0$. We obtain a reformulation of his conditions which should make this task easier.

Let $V^i{}_j = v^i{}_{,j} - \tfrac{1}{3}I\delta^i{}_j$, so that $V^i{}_i = 0$. We note that k is a real root of (1) if and only if $l = k - \tfrac{1}{3}I$ is a real root of

$$\det\,(V^i{}_j - l\delta^i{}_j) = 0, \tag{2}$$

from which it follows that either both of the discriminants of these two cubics vanish, or both are nonzero and of the same sign. Thus, in a, b, c we may replace D by the discriminant E of (2). Using Truesdell's results, we easily obtain

$$E = 4M^3 - 27N^2,$$

where

$$M = -\tfrac{1}{2}\delta^{ij}{}_{kl}V^k{}_iV^l{}_j = \tfrac{1}{2}V^j{}_iV^i{}_j\,,$$
$$N = \det V^i{}_j\,.$$

For an isochoric motion, $I = 0$, so $V^i{}_j = v^i{}_{,j}$. At a point, an arbitrary motion can be decomposed into an isochoric motion for which $V^i{}_j$ are the velocity gradients and a pure expansion or contraction, for which $\tfrac{1}{3}I\delta^i{}_j$ are the velocity gradients, and only the isochoric part influences E. In trying to obtain local characterizations of the three types of motions described in a, b, c, it is thus sufficient to consider only isochoric motions, a fact which is not obvious from Truesdell's analysis. One conclusion is easy to obtain. Letting $D_{ij} = \tfrac{1}{2}(V_{ij} + V_{ji})$, $W_{ij} = \tfrac{1}{2}(V_{ij} - V_{ji})$, we obtain

$$M = \tfrac{1}{2}[D^{ij}D_{ij} - W^{ij}W_{ij}].$$

A necessary condition that $E > 0$ is that $M > 0$. The latter condition holds if and only if

[1] Standard tensor notation is used throughout.
[2] TRUESDELL, C: *The kinematics of vorticity.* Indiana Univ. Publ. Sci. Ser. no. 19. 1954.

$$\mathfrak{W}_K = W^{ij}W_{ij}/D^{kl}D_{kl} < 1, \qquad D^{ij}D_{ij} > 0,$$

where $\mathfrak{W}_K$ is the kinematical vorticity number introduced and studied by Truesdell[2, 3], calculated for the isochoric part of the motion. It can be shown that the kinematical vorticity number calculated for the actual motion is never larger than that mentioned above, so it too must be less than one in order that $E > 0$. A motion for which $E > 0$ is less rotational than a simple shearing motion, for which $\mathfrak{W}_K = 1$ and $E = 0$.

[3] TRUESDELL, C. *Two measures of vorticity.* Journ. Rational Mech. Anal. **2**: 173–217. 1953.

MINERALOGY.—*Thermal analysis and X-ray studies of griffithite.*[1] GEORGE T FAUST, U. S. Geological Survey.

Griffithite was described by Larsen and Steiger in 1917 as a new member of the chlorite group. It was found as fillings in the amygdules of a basalt from Cahuenga Pass, Griffith Park, Los Angeles, Calif. They noted that griffithite "differs so greatly, both optically and chemically, from any of the chlorites previously described as to require a new name. . . ."

In 1928 Larsen and Steiger restudied griffithite, investigating in particular the dehydration and rehydration phenomena. They noted the parallel behavior of nontronite and griffithite on thermal treatment but did not suggest that they might be members of the same group of minerals.

A. N. Winchell (Winchell and Winchell, 1927) considered griffithite to be a member of his leverrierite-stilpnomelane system, closely related to jefferisite.

Orcel (1927) in his comprehensive study of the chlorite group included griffithite within the group, but he was not too convinced, for he writes (p. 307): "Elle possède le clivage habituel des chlorites et renferme une grande quantité d'eau s'échappant à 100°. *Il serait intéressant d'étudier à nouveau sa déshydration.*" (Italics G.T.F.)

Turner and Hutton (1935) described a second occurrence of griffithite in "a fine grained red schist which outcrops in the bed of Twelve-mile Creek Lake Wakatipu District" of Western Otago, New Zealand. This schist contains about 50 percent highly ferruginous green epidote, 25 percent griffithite, 15 percent fine-grained quartz, 8 percent hematite, and, as accessory minerals, a uniaxial pennine, opaque iron ores, and calcite.

Berman (1937), probably following Winchell's classification (1927), classified griffithite as a member of the vermiculite group.

In 1945 Faust (unpublished data), using differential thermal analysis equipment and the tube sample used by Steiger, proved griffithite to be a member of the montmorillonite group.

Ross (1946) independently had arrived at the same conclusion from optical data and classified griffithite as an iron-rich saponite. He recalculated Steiger's analysis in the now conventional form for a member of the montmorillonite group, that is:

$$\frac{(Ca)_{0.50}\ Na_{0.11}}{2}$$

$$\text{II} \quad \text{III} \qquad \uparrow$$

$$[Mg_{1.88}\ Fe_{0.52}\ Fe_{0.44}\ Al_{0.04}]\ [Al_{0.81}\ Si_{3.19}]\ O_{10}[OH]_2$$

and noted that the presence of 7.83 percent of FeO is the highest recorded for any member of the montmorillonite group.

DESCRIPTION AND CHEMICAL ANALYSES

Griffithite locality: Cahuenga Pass, Griffith Park, Los Angeles, Calif. Tube sample prepared by Steiger for analysis, U.S.G.S. Record no. 3112-B (Steiger's No. 1444-b). Analysis 1, Table 1.

Saponite locality: Cathkin, Carmunnock Parish, County Lanarkshire, Scotland, U.S.G.S. Record no. D-67. Analysis 2, Table 1.

Thuringite locality: Schmiedefeld, near Saalfeld, Thuringia, Germany, U.S.N.M. no. R-4554. Analysis 3, Table 1, is on similar material described by Jung and Köhler (1930).

Chlorite (Prochlorite?) locality: Prince's Soapstone Quarry, on the Schuylkill River, approximately one-quarter mile south of Lafayette Station, Philadelphia County, Pa. No analyses.

Leuchtenbergite locality: Nevada Tungsten mine near Gabbs, Nev. Analysis 4, Table 1.

[1] Publication authorized by the Director, U. S. Geological Survey.

TABLE 1.—CHEMICAL ANALYSES OF GRIFFITHITE, SAPONITE, THURINGITE, AND LEUCHTENBERGITE

No.	1	2	3	4
Mineral	Griffithite	Saponite	Thuringite	Leuchtenbergite
Locality	Cahuenga Pass, Los Angeles, Calif.	Cathkin, County Lanarkshire, Scotland	Schmiedefeld near Saalfeld, Thuringia, Germany	Nevada Tungsten mine, near Gabbs, Nev.
SiO_2	39.64	40.16	20.82	31.02
Al_2O_3	9.05	8.03	17.64	20.79
Fe_2O_3	7.32	8.50	8.70	0.04
FeO	7.83	3.83	37.96	1.20
MgO	15.80	19.40	4.15	34.25
MnO	—	—	—	trace
CaO	2.93	1.91	—	0.02
Na_2O	0.71	—	—	0.51
K_2O	none	—	—	0.07
TiO_2	—	—	trace	trace
P_2O_5	—	—	—	0.01
H_2O^-	12.31	11.15	0.07	0.03
H_2O^+	4.90	7.60	10.31	12.77
Σ	100.49	100.58	99.65	100.71

Analyst: 1. G. Steiger, 2. L. T. Richardson, 3. H. Jung and E. Köhler, 4. C. Milton.

DIFFERENTIAL THERMAL ANALYSIS

The differential thermal analysis apparatus used in this study is a modification of that designed by Alexander, Hendricks, and Nelson (1939). A description of the techniques used in the Geochemistry and Petrology Laboratory, U.S. Geological Survey, has been given by Faust (1948) and (1950). The samples were heated at the rate of 12°C. per minute. The records were obtained as photographs.

Differential thermal analyses curves of griffithite, saponite, thuringite, chlorite, and leuchtenbergite were prepared under the same experimental conditions. In addition a sample of thuringite was placed in the furnace and vented with two holes by means of a stiff wire. Venting a charge, after it has been tamped in place, produces a group of holes in the charge so that a series of paths are available for the escape of gases from the charge or the passage of the furnace gases into the vent holes. The results of the DTA experiments are given in Fig. 1, and the data are summarized in table 2.

The selection of the chlorites, thuringite, chlorite, and leuchtenbergite for study was to provide for comparison an iron-rich chlorite, thuringite, and two other chlorites giving typical curves for the chlorite group. Orcel (1927, 1929) has published curves for typical chlorites that he studied which are similar to the curves for chlorite and leuchtenbergite shown in Fig. 1.

A study of these curves shows conclusively that griffithite is related to saponite and is thus a member of the montmorillonite group. The differential thermal analysis curve for griffithite is totally unrelated to the curves of the chlorites. Chlorites differ

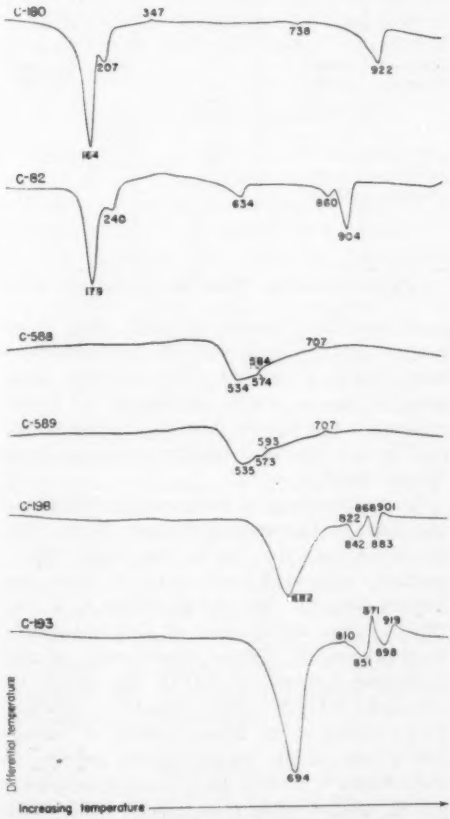

FIG. 1.—Differential thermal analysis curves for griffithite, C-180; saponite, C-82; thuringite, C-588; thuringite, vented with two holes, C-589; chlorite, C-198; leuchtenbergite, C-193. The temperature on the left is about 25°C, the temperature at the termination of the curves, on the right, is about 1000°C.

TABLE 2.—OBSERVATIONS ON THE THERMAL ANALYSIS CURVES[1] OF GRIFFITHITE, SAPONITE, THURINGITE, CHLORITE, AND LEUCHTENBERGITE

Mineral	Record no.	Temperature of Peaks (°C)												Locality	Weight of sample used (grams)
		Low temperature			Intermediate temperature					High temperature					
		Endothermic		Exothermic	Endothermic				Exothermic	Endothermic	Exothermic	Endothermic	Exothermic		
Griffithite	C-180	164	207	347	—	—	—	738	—	—	—	922	—	Cahuenga Pass, Griffith Park, Los Angeles, Calif.	0.4625
Saponite	C-82	179	240	Present (Broad hump)	—	—	634	—	—	860	—	904	—	Cathkin, Carmunnock Parish, County Lanarkshire, Scotland.	0.5290
Thuringite	C-588	—	—	—	534	574	584	—	707	—	—	—	—	Schmiedefeld, near Saalfeld, Thuringia, Germany.	0.5323
Thuringite	C-589	—	—	—	535	573	593	—	707	—	—	—	—	Same as above.	0.5905
Chlorite	C-198	—	—	—	—	—	682	—	822	842	868	883	901	Prince's Quarry Lafayette Station, Philadelphia County, Pa.	0.5185
Leuchtenbergite	C-193	—	—	—	—	—	694	—	810	851	871	898	919	Nevada Tungsten mine near Gabbs, Nev.	0.5540

[1] These curves were all obtained with a resistance of 600 ohms in the galvanometer circuit.

from montmorillonite in that they have only a negligible amount of "low-temperature" water and that they undergo their greatest loss in water content at an intermediate temperature. For the curves given in Fig. 1, the temperature range is from 535 to 695°C.

It is interesting to compare the dehydration data of Larsen and Steiger (1928) with the DTA curves given in this paper. Their studies required 5 to 7 hours to raise the temperature of the sample from 25°C. to 290°C., after which most of the water had been driven off. Optical examination of the griffithite heated to 290°C. led them to conclude: "Their crystal structure does not break down even when heated at about 300°C. at which temperatures nearly all their water is driven off." Their conclusions are in accord with the present work. The DTA studies show lower temperatures for the peaks representing the loss of the "low-temperature" water, as would be expected when more rapid rates of heating are employed.

X-RAY STUDIES

X-ray data for griffithite.—The X-ray data on griffithite were obtained using a portion of the tube sample prepared by Steiger. This material had been kept tightly corked and represents the air-dried mineral. The samples for X-ray analysis were prepared as spindles with Duco cement as the mounting medium. The patterns were made using filtered copper radiation. The indices were assigned following the methods given by Brindley (1951). The value of the b parameter was calculated from the 06 reflection. The results of this work are given in table 3 along with data for saponite (Faust, 1951) and thuringite (Von Engelhardt, 1942).

A comparison of the data in Table 3 shows that the X-ray powder diffraction data for griffithite and saponite are in good agreement, allowing for differences in composition, whereas the data for the iron-rich chlorite, thuringite, are totally unrelated to these montmorillonite minerals. A portion of the griffithite was treated with ethylene

glycol, packed into a Lindemann glass capillary tube, and examined by X-ray techniques. The resulting X-ray powder diffraction pattern showed that the positions of the basal reflections (00l) had shifted. The value for (00l) was found to be 18.0 ± A. The results of the study by X-ray methods show that griffithite is a member of the montmorillonite group.

Identification of the phases formed from the dissociated minerals.—X-ray powder diffraction patterns were obtained from the products remaining after the dissociation had taken place and the samples had been heated to about 1000°C. The results are as follows:

1. Dissociated griffithite, sample C-180, consists of maghemite, cristobalite, and hypersthene. The quality of the X-ray powder pattern obtained from this material is fair.

2. Dissociated saponite, sample C-82, consists of hypersthene, hematite, and cristobalite. The quality of the X-ray powder pattern is fairly good.

3. Dissociated thuringite, samples C-588 and C-589, seems to contain a spinel-group mineral, probably maghemite. The X-ray patterns obtained from these two samples are rather poor, and they both contain the same lines, but the number of lines present is small and they are rather broad and diffuse.

TABLE 3.—X-RAY POWDER DIFFRACTION DATA FOR GRIFFITHITE, SAPONITE, AND THURINGITE (Cu/Ni; λ = 1.5418A)

Griffithite Cahuenga Pass, Calif.			Saponite Cathkin near Glasgow, Scotland			Thuringite Schmiedefeld, Germany; after Von Engelhardt, 1942		
Indices	*d*(*A*)	*I*	*Indices*	*d*(*A*)	*I*	*Indices*	*d*(*A*)	*I*
001	15.4	vs	001	14.8	vs			
						001	13.6	ms
002	7.9	m	002	7.71	m b			
						002	6.89	vs
003	5.28	vw	003	5.14	vw b			
11, 02	4.60	m	11, 02	4.59	ms b	003, 020	4.62	s
				4.34	vw			
004	3.93	vw	004	3.79	vw			
						004	3.48	vs
005	3.13	m	005	3.09	m			
						005	2.796	m
13, 20, 006	2.648	m	13, 20	2.613	m	—		
						202, 131	2.602	ms
	2.560		006	2.545	m d	—		
	2.452	vw				203, 132	2.451	ms
						202, 133	2.384	ms
04, 22	2.298	vw				204, 133	2.259	ms
						204, 135	1.995	s
				1.852	vw	206, 135	1.875	mw
						205, 136	1.809	w
15, 24, 31	1.740	vw	15, 24, 31	1.747	w			
						207, 136	1.713	vw
				1.703	w			
						206, 137	1.654	w
06, 33	1.541	ms	06, 33	1.543	s b	060, 331	1.551	s
						062, 331, 333	1.513	mw
				1.495	vw			
				1.458	vw	209, 138, 333	1.419	vw
						0.0.10	1.405	vw
						208, 139	1.386	m
26, 40	1.330	w	26, 40	1.327	m b	400	1.332	w
			17	1.278	vw b			
19, 46, 53	1.001	vw						
			19, 46, 53	0.999	vw d			
60, 39	0.888	vw	60, 39	0.890	vw b			

b = broad.
d = diffuse.

SUMMARY AND CONCLUSIONS

This paper presents the experimental evidence for classifying griffithite as a member of the montmorillonite group and withdrawing it from the chlorite group.

The inclusion of griffithite and cronstedtite in the chlorite group of minerals has always posed some difficulties in the correlation of their optical properties with those of the other members. The strong birefringence of cronstedtite and griffithite ($\gamma - \alpha = 0.087$) can not be correlated with the low birefringence of the chlorites. Hendricks (1939) showed that the crystal structure of cronstedtite ($2FeO \cdot Fe_2O_3 \cdot SiO_2 \cdot 2H_2O$) is related to that of kaolinite. With the reclassification of griffithite as a montmorillonite, two of the principal enigmas have been removed from the puzzling accumulated data on the chlorites. The recent experimental demonstration of polymorphism in this group by Brindley, Oughton, and Robinson (1950) will further simplify the relationships.

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PALEONTOLOGY.—*Notes on Permian rhynchonellids.* FRANCIS G. STEHLI, California Institute of Technology, Pasadena, Calif.[1] (Communicated by David H. Dunkle.)

Attention has frequently been called to the intensive diversification of Jurassic rhynchonellids. Cooper and Williams (1952, p. 330) have pointed out, however, that this expansion is in part an artifact of the literature resulting from the contrast between the intensive splitting of Jurassic forms and a more conservative treatment of those of the Triassic. These investigators have also noted that the rhynchonellid deployment actually began at least as early as the Triassic. This observation is readily confirmed by a survey of literature on Triassic brachiopods, for it indicates the presence of a large number of still unrecognized rhynchonellid genera. The Mesozoic expansion may have resulted from reduced competition concomitant with the termination or severe reduction of many brachiopod lines at the close of the Paleozoic. Such a condition would have favored the rapid expansion of pre-adapted rhynchonellid phyla. Whether or not this was the case, the late Paleozoic, and particularly Permian rhynchonellid faunas, are of unusual significance for here are to be found the stocks ancestral to the Mesozoic diversification.

Rhynchonellids are not common in the Permian of North America. They are, however, more diverse than the present literature indicates. Recent collecting in the Wordian rocks of the Guadalupe Mountains, Tex., has revealed the presence of several new forms and allows increased detail in our knowledge of some previously described forms. Because of the unusual evolutionary interest attaching to Permian rhynchonellids, those forms represented by sufficiently abundant and perfect material are described below.

All the specimens studied are siliceous replacements prepared by acid etching of material collected in the upper part of the lower Getaway member of the Cherry Canyon formation. The collections were made near Pine Springs Camp, Tex., between U. S. Highway 62 and the Pasotex pipeline road on the west side of a road leading from U. S. 62 to the Airways Station.

[1] Publications of the Division of the Geological Sciences, California Institute of Technology, Pasadena, California. Contribution No. 702.

The best silicified material was found on the ridge crest south of the middle gully of a group of three running east-west and draining into the water course parallel to the road. All the easily accessible worthwhile material has been collected. The etched faunas are housed at the American Museum of Natural History in New York City, the United States National Museum in Washington, D. C., and at the California Institute of Technology, Pasadena, Calif.

The deposits from which the fossils were collected appear to represent a detrital fan adjacent to a small reef, though the latter has been largely removed by erosion. Some specimens are in position of growth, but much of the material is detrital. The locality is remarkable for the diversity of its fauna. Invertebrate groups represented in the approximate order of abundance are Brachiopoda, Fusulinidae, Bryozoa, Porifera, Gastropoda, Pelecypoda, Echinoidea, Tetracoralla, Crinoidea, Ammonoidea, Nautiloidea, Trilobita, Amphineura, and Scaphopoda. The rhynchonellid brachiopods are found largely in the detrital material about the reef, but occur sparingly in blocks in which much of the material is in position of growth.

The material here described and figured is housed in the paleontological collections of the American Museum of Natural History in New York City.

Superfamily RHYNCHONELLACEA Schuchert, 1896

? Family CAMAROTOECHIIDAE Schuchert, 1929

Genus **Fascicosta**[2] Stehli, n. gen.

Genotype.—*Rhynchonella ? longaeva* Girty.

Diagnosis.—Small impunctate uniplicate incipiently fasciocostate Permian rhynchonellids ornamented with fine concentric lines; foramen small, subapical; deltidial plates large; pedicle interior with dental plates; brachial interior with hinge plate undivided and supported by a broad median ridge or low septum; teeth and sockets denticulate.

Range.—Wordian to Capitanian.

Discussion.—The incipiently fasciostate ribbing of this genus is very unusual for a rhynchonellid. Insofar as the writer is aware it is approached among upper Paleozoic members of the group only by *Allorhynchus ramosum* Bell from the Windsor group of Nova Scotia in which there is bifurcation of the costae. The form described by Bittner (1890, p. 192) as *Rhynchonellina juvavica* from the Triassic deposits in the Alps also exhibits fasciocostation but bears a divided hinge plate and is thus generically distinct.

The strong denticulation of the hinge teeth and sockets is not unusual in Permian rhynchonellids and has been noted in several genera by Cloud (1944, p. 55). Extensive and detailed studies will be necessary to determine its presence or absence in other genera and its taxonomic significance.

[2] Lat. *fascis*, bundle; Lat. *costa*, rib.

Fascicosta longaeva (Girty)

Figs. 1–17

Rhynchonella ? longaeva Girty, U. S. Geol. Surv. Prof. Pap. 58: 322–323, pl. 15, figs. 18–19. 1909.

Material.—This species is represented by two complete specimens, AMNH 27904:1 and AMNH 27904:2. In addition there are seven pedicle and four brachial valves, all of which are more or less complete, which collectively bear the designation AMNH 27904.

Diagnosis.—Small subpentagonal rhynchonelliform shells. Pedicle valve slightly convex; sulcus well developed, beginning near midlength and containing 2 to 4 costae on the floor of the valve, while each lateral margin usually bears a smaller one; beak long, little incurved; foramen small, subapical, limited by large conjunct deltidial plates. Brachial valve strongly convex; fold low with 3 to 5 costae on top and a smaller one at each side. Each valve ornamented with 15 to 25 fine high rounded costae extending to the beak and increasing toward the front by bifurcation and implantation; the entire shell surface bearing fine concentric lines.

Pedicle interior with small dental plates; position of the muscle insertions indeterminable. Brachial interior with a raised undivided hinge plate separated from the lateral shell walls by deep denticulate sockets; hinge plate bearing posteriorly a slight depression which received the diductor muscles; hinge plate supported by a low broad ridge or rarely by a low but well developed septum; crura not observed; anterior adductor scars depressed, elongate, located at either side of the ridge or septum near its anterior end; posterior adductor scars raised, located posterior to the other pair and anterolaterally directed.

Measurements in millimeters of two specimens are as follows:

Length	9.8	10.2
Width	10.2	11.2
Thickness	6.9	7.8

Range.—I have found this species in the lower part of the Getaway member of the Cherry Canyon formation. It has been reported by Girty (1909, p. 323) from the Capitan limestone on Capitan Peak and from several somewhat questionable localities in the vicinity. It is unknown outside the Guadalupe Mountains.

Discussion.—In his original description of the species Girty (1909, p. 322) expressed doubt as to its exact generic placement. He placed it questionably with *Rhynchonella*. It is so distinctive as to deserve a position as the genotype and only known species of a new genus.

Fascicosta longaeva (Girty)

FIG. 1.—Pedicle exterior showing fascicostation and prolongation of costae onto the umbo. AMNH 27904:1 (×2). FIG. 2.—Pedicle exterior showing increase of costae by bifurcation. AMNH. 27904:2 (×2). FIG. 3.—Exterior of brachial valve showing the fine concentric ornamentation characteristic of the species. AMNH 27904:1 (×7). FIG. 4.—Brachial exterior showing increase of costae by implantation and the extension of costation onto the umbo. AMNH 27904:1 (×2). FIG. 5.—Brachial exterior showing extension of costae onto the umbo and the small pedicle foramen and large deltidial plates of the pedicle beak. AMNH 27904:2 (×2). FIG. 6.—Brachial interior showing the reflection of the external ornamentation and also the undivided hinge plate. AMNH 27904:3 (×2). FIG. 7.—Profile showing the strong convexity of the brachial valve and the lesser convexity of the pedicle valve. AMNH 27904:1 (×2). FIG. 8.—Posterior showing extension of costation onto the umbo, pedicle valve slightly broken. AMNH 27904:2 (×2). FIG. 9.—Posterior view showing the increase anteriorly of the costae. AMNH 27904:1 (×2). FIG. 10.—Anterior showing irregular lamination of the valves near the front and the nature of the fold and sulcus. AMNH 27904:2 (×2). FIG. 11.—Profile showing unequal convexity of the two valves. AMNH 27904:2 (×2). FIG. 12.—Anterior showing irregular laminae and the nature of the fold and sulcus. AMNH 27904:1 (×2). FIG. 13.—Pedicle interior showing hinge teeth and dental plates and unusual plate partly shutting off the rostral cavity. AMNH 27904:4 (×2). FIG. 14.—Brachial interior of a specimen with a small median septum, showing the undivided hinge plate. AMNH 27904:7 (×2). FIG. 15.—Hinge plate showing denticulation of dental socket. AMNH 27904:6 (×5). FIG. 16.—Pedicle interior showing the small pedicle foramen and large deltidial plates and the adductor and diductor muscle scars. AMNH 27904:4 (×2). FIG. 17.—Brachial interior of a specimen without a median septum showing the undivided hinge plate and depressed posterior adductor scars and raised anterior adductor scars. AMNH. 27904:5 (×2).

Allorhynchus ? permianus Stehli, n. sp.

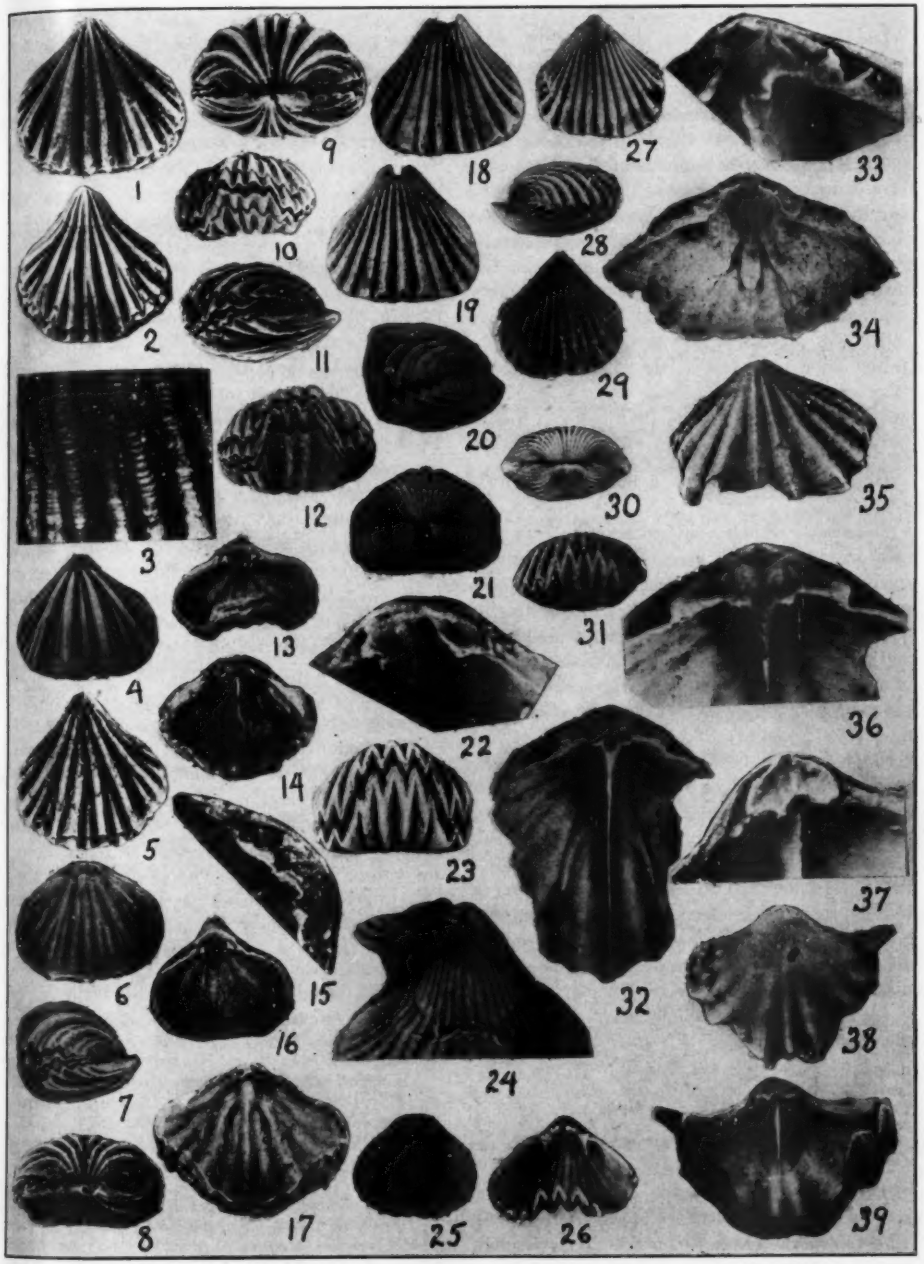
FIG. 18.—Pedicle exterior of a specimen with the pedicle beak missing but paucicostate ornamentation evident. AMNH 27905:1 (×2). FIG. 19.—Brachial exterior showing paucicostate ornamentation. AMNH 27905:1 (×2). FIG. 20.—Profile of specimen with the pedicle beak missing and the two valves gaping slightly. AMNH 27905:1 (×2). FIG. 21.—Posterior showing the extension of paucicostation onto the umbo. AMNH 27905:1 (×2). FIG. 22.—Hinge plate showing its divided nature and at the left the teeth in the denticulate hinge socket. AMNH 27905:2 (×7). FIG. 23.—Anterior view showing the nature of the fold and sulcus. AMNH 27905:1 (×2). FIG. 24.—Umbo of the brachial valve and underside of the beak of the pedicle valve showing the large pedicle foramen and the very small deltidial plates, which fail to close above the brachial valve. AMNH 27905:3 (×5). FIG. 25.—Brachial interior showing the divided hinge plate and the internal reflection of costation. AMNH 27905:2 (×2). FIG. 26.—Pedicle interior showing the well developed dental plates. AMNH 27905:4 (×2). FIG. 27.—Pedicle exterior showing paucicostate ornamentation extending onto the umbo. The holotype, AMNH 27905:5 (x2). FIG. 28.—Profile showing the unequal convexity of the valves. The holotype AMNH 27905:5 (×2). FIG. 29.—Brachial exterior showing paucicostate ornament and the large almost unrestricted pedicle foramen. The holotype AMNH 27905:5 (×2). FIG. 30.—Posterior view showing extension of costation onto the umbones. The holotype AMNH 27905:5 (×2). FIG. 31.—Anterior view showing the nature of the fold and sulcus. The holotype AMNH 27905:5 (×2).

Leiorhynchoidea cloudi Cooper

FIG. 32.—Brachial interior showing hinge plate and median septum as well as adductor muscle scars. AMNH 27906:3 (×2). FIG. 33.—Hinge plate and dental socket showing denticulation. AMNH 27906:1 (×5). FIG. 34.—Interior of beak region of the pedicle valve showing the central raised adductor scars, the depressed diductor scars and in the rostral cavity the tracks and scars of the median pedicle muscles. Note also the absolescence of dental plates. AMNH 27906:2 (×2). FIG. 35.—Pedicle exterior showing the strong paucicostate ornamentation and its obsolescence at the umbo. AMNH 27906:4 (×1). FIG. 36.—Detail of the hinge region of the brachial valve showing the medial trough, the median septum, the insertions of the brachial pedicle muscles and the special triangular insertions of the diductor muscles. AMNH 27906:3 (×5).

Wellerella ? sp.

FIG. 37.—Hinge plate and dental socket showing fine denticulation. AMNH 27907:1 (×5). FIG. 38.—Brachial interior showing entire hinge plate, and strong median septum. The floor of the valve shows the adductor scars. AMNH 27907:1 (×2). FIG. 39.—Exterior of brachial valve showing the relatively few costae and their obsolescence on the umbo. AMNH 27907:1 (×2).



FIGS. 1–39.—(See opposite page for explanation).

Genus **Allorhynchus** Weller, 1910

Discussion.—Means for distinguishing this genus from other Mississipian rhynchonellids have been pointed out by Weller (1914, p. 197). There are few known Pennsylvanian or Permian genera with which *Allorhynchus* might be confused. It most nearly approaches *Terebratuloidea* from which it is distinguished by the presence of dental plates. It bears some resemblance to *Uncinunellina ? pulchra* Cooper from the middle Permian of Sonora, Mexico, but differs in the absence of concentric surface ornament and a brachial median septum.

Allorhynchus ? permianus Stehli, n. sp.
Figs. 18–31

Material.—This species is known from 15 more or less complete specimens and from 9 brachial and 11 pedicle valves.

Holotype, AMNH 27905:5. Paratypes, AMNH 27905.

Diagnosis.—Small subpentagonal rhynchonelliform shells. Pedicle valve slightly convex; sulcus shallow, arising near midlength and containing 3 through 4 costae; lateral slopes bearing 5 through 8 costae; beak long, not incurved; delthyrium mostly open, deltidial plates reduced to small triangular projections which may or may not meet above the brachial beak. Brachial valve moderately convex; fold generally low with 4 through 5 costae; beak short and hidden beneath that of the other valves. Both valves paucicostate with 15 to 20 fine angular costae extending to the beak; no other surface ornamentation is present.

Pedicle interior with dental plates and large flat topped denticulate hinge teeth; position of muscle insertions uncertain. Brachial interior with a deeply divided hinge plate; median septum absent; crura long and recurved; sockets denticulate; position of muscle insertions uncertain.

Measurements in millimeters of seven specimens are as follows:

Length	9.1	11.2	10.6	11.0	11.4	9.3	8.4
Width	10.3	11.3	10.7	11.3	10.9	9.5	7.6
Thickness	6.8	7.0	6.6	8.4	5.7	5.6	5.5

Range:—Lower Getaway member of the Cherry Canyon formation (Wordian).

Discussion:—The generic reference of this species is made with some reservations for *Allorhynchus* is unknown in the Pennsylvanian, and in addition there are noteworthy differences between *A. ? permianus* and Mississippian species placed in the genus. Among these is the absence in *A. ? permianus* of concentric striae on the shell surface and the presence of well developed dental plates and strong hinge teeth. In addition, some details of the morphology of the genotype are unknown and make comparison difficult. It is unknown, for instance, whether or not the teeth and sockets of *A. heteropsis* are denticulate. Should they prove not to be, *A. ? permianus* represents a new genus.

MORPHOLOGY OF OTHER PERMIAN RHYNCHONELLIDS

Leiorhynchoidea cloudi was described by Cooper (1953, p. 44) from the middle Permian of Sonora, Mexico. Additional material is present in the Getaway member of the Cherry Canyon formation in the Guadalupe Mountains, and though largely fragmentary shows excellent detail. The sockets in Cooper's material did not show denticulation, but it is clearly present in the material at hand. Its absence in the Mexican specimens is probably due to poor preservation. Cooper noted that the dental plates were greatly reduced in his specimens. In the Guadalupe Mountains specimens they are united in adults with the wall of the rostral cavity. In addition to the muscle scars noted by Cloud (1944, p. 57) in *Leiorhynchoidea*, Guadalupe Mountains material shows in the rostral cavity the pair of small median pedicle muscle scars characteristic of modern rhynchonellids.

The examination of a large number of specimens of various rhynchonellid species currently assigned to *Wellerella* and taken from various Permian horizons has shown that the teeth and sockets are denticulate. Insofar as I am aware, the nature of the teeth and sockets has not been ascertained for the genotype, *W. tetrahedra*, and the question deserves further study in the interests of achievement of a natural classification.

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ZOOLOGY.—*Some Rhizocephala found on brachyuran crabs in the West Indian region.* EDWARD G. REINHARD, Catholic University of America.

The present paper contains notes on six species of the genus *Sacculina* which occur in the Gulf of Mexico and the Caribbean Sea. Two of these are described as new and are named *Sacculina americana* and *Sacculina boschmai*. The specimens reported on are chiefly recent accessions of the United States National Museum which were lent to the writer for study. The drawings (except Fig.1) were made by Miss Pei-Tsing Liu.

In addition to the species treated here, there are two other members of the genus reported for the West Indian region. These are *Sacculina hirsuta* Boschma, which occurs on *Pilumnus caribaeus* and *Pilumnus dasypodus* (Boschma 1925, 1931; Reinhard 1950), and *Sacculina schmitti* Boschma 1933, 1950) known only from the type specimen found on *Anomalothir furcillatus*.

Sacculina bicuspidata Boschma

Fig. 1

Sacculina bicuspidata Boschma, 1931, pp. 342–344, fig. 7, 1 (external appearance), fig. 31 (longitudinal sections), fig. 32 (external cuticle); 1937, pp. 212–213, fig. 8 (male organs and colleteric glands).

Type specimen on *Microphrys bicornutus* (Latreille). Tobago, British West Indies.

Material examined.—Eastern shore, St. Thomas, Virgin Islands, St. Thomas Harbor, station 23, April 4, 1937; two specimens on two *Microphrys bicornutus* (Latreille). Smithsonian-Hartford Expedition. U.S.N.M. 92179.

Gulf of Mexico, *Oregon* station 279, 29° 11′ N., 86° 52.5′ W., 305 fathoms; February 24, 1950; one specimen on *Trachycarcinus spinulifer* Rathbun. U. S. Fish and Wildlife Service coll. U.S.N.M. 92355.

The larger of the two specimens from St. Thomas measures 5 mm in length, 5.5 mm in breadth, and 2 mm in thickness; the smaller one, 3 by 3 by 1.5 mm. In both cases the mantle opening is elevated but not conspicuously so. The posterior angles of the larger specimen are drawn out into lappets. The external cuticle bears delicate rugae resembling a fingerprint pattern. Both specimens have eggs in the mantle cavity and are therefore mature.

Sections were made of the smaller specimen. The thick-walled, cylindrical testes, located outside the visceral mass, are separate tubes of approximately equal size that merge gradually into short vasa deferentia. The vasa twist slightly near their terminations. A muscular sheath surrounds each testis. The colleteric glands are one or two rows in thickness with about 20 tubes visible in the most divided portion. The innermost tubes, where the gland is thickest, form large sinuslike spaces.

The specimen from *Oregon* station 279 measures 5.5 mm in length, 6 mm in breadth, and 2 mm in thickness, dimensions which correspond almost exactly with those given for the type specimen. It is also similar to the type in having a straight posterior border and the mantle opening at the summit of a rather prominent tube.

The testes occur in the stalk region in a muscular portion outside the visceral mass. They

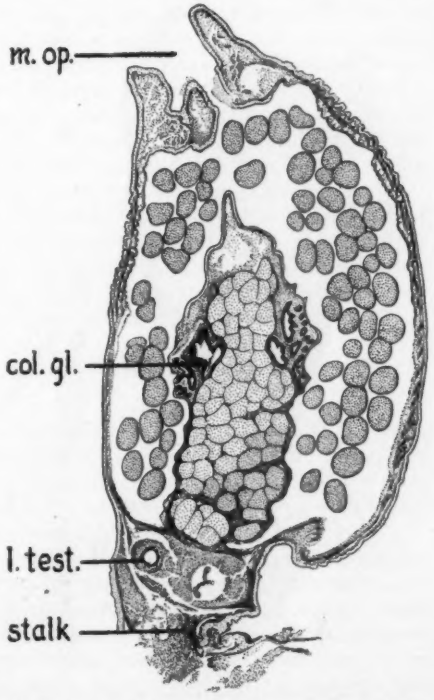

FIG. 1.—*Sacculina bicuspidata* Boschma. Longitudinal section of parasite found on *Microphrys bicornutus* (Latreille). m. op., mantle opening; col. gl., colleteric gland; l. test., left testis.

are approximately of the same size and comparatively large and thick-walled. At first they are solid; a lumen appears only in the proximal half from which the vasa deferentia originate. They run a straight course close together, then later they touch but never become fused.

The vasa deferentia appear gradually, run straight at first in a ventral direction, then diverge to the right and left and become slightly twisted as they terminate on either side of the posterior tip of the visceral mass.

The colleteric glands, located in the anterior half of the visceral mass, consist, in the main, of one row of tubes with a few large sinuses toward the interior. The maximum number of tubes seen in any one section is 20 to 22.

The eggs in the visceral mass are extremely small and no embryos are present in the mantle cavity. This, in conjunction with the fact that the testes are in part solid, indicates an immature animal.

Sacculina americana, n. sp.

Fig. 2

Cotypes.—Gulf of Mexico, *Oregon* station 319, 29° 20′ N., 87° 25′ W., April 28, 1951; four specimens on one *Trachycarcinus spinulifer* Rathbun. U. S. Fish and Wildlife Service coll. U. S. N. M. 96988.

Diagnosis.—Sac broadest in anterior half, tapering to stalk posteriorly. Male genital organs outside the visceral mass. Testes globular, thin-walled, completely separated, one larger than the other. Vasa deferentia narrow, emerging abruptly from the testes. Colleteric glands shallow with a comparatively small number of tubes. External cuticle etched with short irregular branching grooves. Internal cuticle with retinacula consisting of one or two spindles, particularly abundant in the vicinity of the mantle opening.

Description.—This species of *Sacculina* has a rather unusual shape. All four specimens are

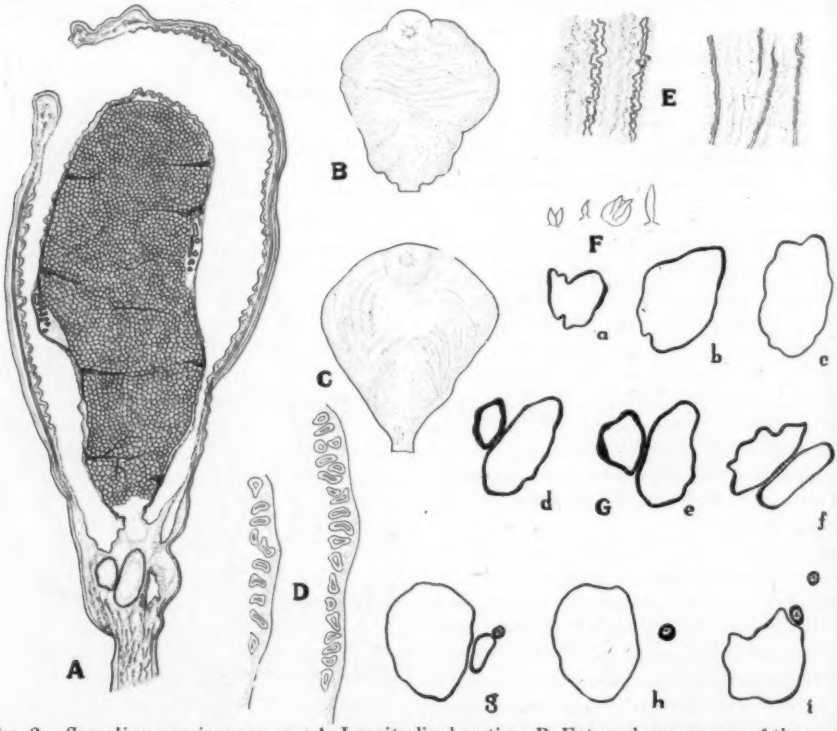

FIG. 2.—*Sacculina americana*, n. sp.: A, Longitudinal section; B, External appearance of the smallest specimen, × 3. C, External appearance of the largest specimen × 2. D, Longitudinal sections of the colleteric glands. E, Surface of the external cuticle. F, Retinacula. G, Series of transverse sections of the male genital organs starting from the distal end of the right testis (a) and ending with the proximal end of the left testis (*i*) and the vasa deferentia (*g*, *h*, *i*).

broadest in the anterior half and taper gradually to the stalk. The prominent mantle opening, surrounded by a thick pad, is in the center of the anterior surface but turned to the left side. The smallest specimen measures 10 mm in length, 9 mm in breadth and 4 mm in thickness; the largest 15 by 13 by 5 mm.

One parasite was treated with KOH for a study of the cuticulas and the largest member of the group was selected for sectioning. The external cuticle has a thickness of 24 to 32μ. Its surface is engraved with minute sinuous grooves that have short side branches. This pattern is broken by more widely spaced deeper grooves. In cross section the external cuticle has a ragged appearance and its surface takes a darker stain than the interior. The internal cuticle has sparse retinacula except in the vicinity of the mantle opening where they are extremely abundant and crowded together in islandlike groups. Each retinaculum consists of an elevation bearing one or two pointed spindles. The spindle measure 20 to 30μ in length.

The globular testes, located near the base of the stalk outside the visceral mass are thin-walled and lie directly alongside each other. The right testis is noticeably larger and longer than the left, but spermatozoa are present in both. The slender vasa deferentia emerge from the upper end of the testes as straight tubes that quickly diverge in an antero-ventral direction and become slightly twisted as they terminate.

The colleteric glands are shallow, with 20 to 23 tubes in the region of maximum division. They contain a chitin lining.

Sacculina reniformis Boschma

Fig, 5, A, B, C

Sacculina reniformis Boschma, 1933, p. 227, fig. 9 (external cuticle); 1937, pp. 300–301, fig. 75 (male organs and colleteric glands); 1950, p. 19, fig. 1, i (external appearance), fig. 6, b (longitudinal section).

Type specimen on *Podochela riisei* Stimpson, off Cape Sable, Fla.

Material examined.—Gulf of Mexico, *Oregon* station 36; 28° 30′ N., 85° 36′ W., 120 fathoms; June 27, 1950; two specimens on two *Collodes leptocheles* Rathbun. U. S. Fish and Wildlife Service coll. U. S. N. M. 91107.

The larger specimen measures 4.5 mm in length, 7 mm in width and about 4 mm in thickness; the smaller one, 4 by 6 by 3.5 mm. Both are slightly larger than the type specimen. The mantle opening, described in the type as lying "at the extremity of a very short, rather wide tube," is relatively small and inconspicuous in these examples, but protrudes a little above the surface. The presence of Liriopsid parasites in the mantle cavity of both specimens has apparently caused some distortion in the shape of the sacs. Their contour, although reniform, is somewhat angular.

The external cuticle of both specimens is covered with small dentate excrescences about 6 to 8μ in height. Except for the presence of a few short hairs on the tip and sides of these processes, they are exactly like those illustrated for the type specimen (Boschma, 1933, fig. 9).

The numerous retinacula found on the internal cuticle are single spindles, extremely variable in size and shape and ranging from 14 to 35μ in length. No retinacula were seen in the type specimen, but failure to find them is not always proof that they do not exist.

The testes lie outside the visceral mass in the posterior region of the body. They begin on the dorsal side of the animal not far from the edge of the stalk. At first they are completely fused so that there is only one lumen. Then two lumena appear, but the intervening walls remain united. Shortly after, without diverging, they gradually pass into the vasa deferentia that become smaller as they approach their terminations. The vasa deferentia are relatively short tubes, slightly coiled just before they terminate.

The colleteric glands occur in the anterior half of the visceral mass and contain only a few tubes. About 10 tubes appear in the most divided portion of the gland. The glands project slightly from the surface of the visceral mass.

Sacculina boschmai, n. sp.

Figs. 3, 4

Type.—Gulf of Mexico, west coast of Florida, *Albatross* station 2401, 28° 38′ 30″ N., 85° 53′ 30″ W., 142 fathoms, March 14, 1885; one specimen on *Acanthocarpus alexandri* Stimpson. *Albatross* coll. U. S. N. M. 96989.

Diagnosis.—Sac broadly oval, with greatest diameter along dorso-ventral axis; mantle opening and stalk prominent. Male genital organs outside visceral mass; testes cylindrical, separate; right testis enlarged, left rudimentary. Vasa deferentia slightly coiled at terminations. Colleteric glands in anterior half of visceral mass with a moderate number of tubes. External cuticle of mantle with short papillae approximately 12μ

long, covered with minute hairs and staining more darkly than the rest of the cuticle. Retinacula consisting of a basal part and one or two smooth spindles about 15μ long.

Description.—The parasite measures 9 mm in length, 12 mm in width and 5 mm in thickness. The sac, one-third broader than long, is convex at the anterior and posterior margins and strongly arched at the dorsal and ventral margins. The thick stalk arises from a depression on the left side of the animal near the posterior end. The mantle opening, also shifted slightly to the left, is at the center of the anterior surface opposite the stalk. It is encircled by a heavy ridge with prominent folds.

In surface view the external cuticle has a rough "shark-skin" appearance due to innumerable excrescences set close together. These are short, pointed papillae or denticles, covered with minute hairs. The excrescences have a length of 10 to 15μ and in sections it may be seen that they take a darker hematoxylin stain than the subsurface cuticle. For the most part, the external cuticle is 50 to 70μ in thickness.

Retinacula, consisting of a basal hump and one or two smooth spindles, are present on the internal cuticle. They have a length of 14 to 17μ.

The testes occur in the thick mesentery of the stalk region completely outside the visceral mass. The right testis is greatly enlarged while the left testis is rudimentary and attached to the wall of the right testis. Each testis is surrounded by a muscular sheath. A peculiar feature of the histology of the right testis is the unusually large number of nutritive or supporting cells present. These are very large clear cells, one to three rows deep, around which the spermatocytes and spermatids are clustered.

The functional testis has the shape of a wide cylindrical sac, tapering at both ends. The wall appears to be of rather delicate construction and presumably, because it lacks any firm tissue, yields to contractions in such a way that in cross-section this testis has an irregular rather than a smoothly rounded outline.

The vasa deferentia emerge gradually from the ventral extremities of both testes. They are rather narrow tubes, straight for most of their course, becoming coiled only at their terminations.

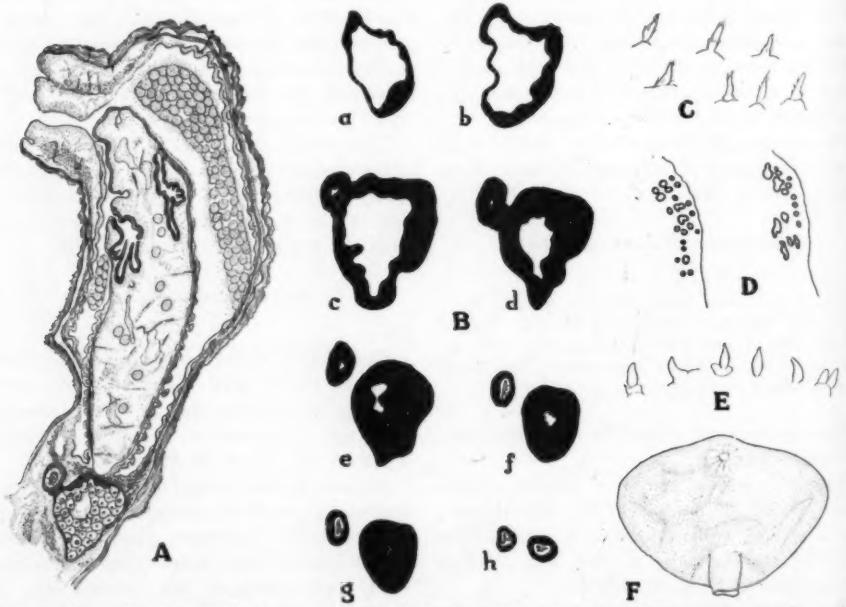

FIG. 3.—*Sacculina boschmai*, n. sp.: A, Longitudinal section. B, Series of transverse sections of the male genital organs starting from the distal end of the right testis (a) and ending with the vasa deferentia (h). The rudimentary left testis appears in c, d and e. C, Excrescences of the external cuticle. D, Longitudinal sections of the colleteric glands. E, Retinacula. F, External appearance seen from the left side.

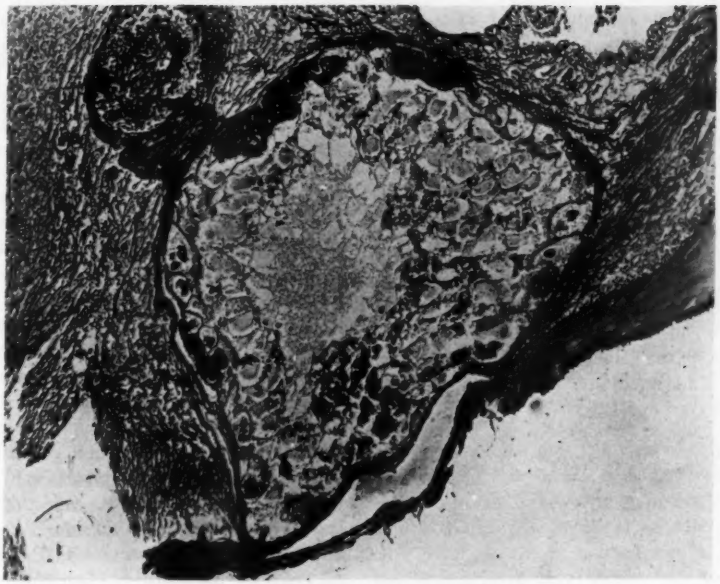

FIG. 4.—*Sacculina boschmai*, n. sp. Photomicrograph showing the histological structure of the testes

The colleteric glands occur in the anterior half of the visceral mass. Each gland consists of three rows of tubes. These are not gathered into compartments. The maximum number of tubes seen in a cross-section of one gland is 24.

The ovary of this specimen appears to be exhausted, but there are numberous eggs in the mantle cavity, particularly on the right side of the visceral mass, where the cavity is considerably more voluminous.

At the exit from the mantle cavity the body wall increases more than three times in thickness where it forms thick folds around the mantle opening. A prominent sphincter muscle is present here and a series of blood lacunae occur in the space between the sphincter and the external cuticle.

Remarks.—This is the specimen recorded by Rathbun (1937, p. 227) in her monograph on oxystomatous crabs, where it is referred to as "Peltogaster."

Sacculina pustulata Boschma

Fig. 5, D

Sacculina pustulata Boschma, 1925, pp. 11–12, text figs. 2 and 3 (external cuticle), pl. 2, fig. 2 (external appearance), fig. 6 (longitudinal section), fig. 7 (vas deferens); 1937, pp. 298–299, fig. 73 (male organs and colleteric gland).

Type specimen on *Hemus cristulipes* A. Milne Edwards.

Type locality: Spanish Water, Curaçao.

Material examined.—10 miles southeast of Alligator Point, Franklin County, Fla., 6 fathoms, November 28, 1952; one specimen on *Hemus cristulipes* A. Milne Edwards. M. L. Wass coll. U. S. N. M. 94050.

This is a very small parasite, although fully mature. It has a length of 2 mm, a breadth of 2 mm, and a thickness of 1 mm. In external appearance it agrees with Boschma's description of the somewhat larger type specimen both with respect to shape and to the fact that the eggs in the mantle cavity are visible through the thin mantle and impress upon it a hexagonal pattern.

The testes are completely separated, unequal in size, and located outside the visceral mass. The short vasa deferentia become quite narrow and contorted near their terminations and have a heavy chitin lining. The colleteric glands have few tubes.

The host, a small crab measuring only 5.5 mm in carapace length and 4.0 mm in carapace width, shows marked effects of sacculinization. It is a modified male with prominent copulatory pleopods but possessing additional pleopods of the female type and a broad abdomen.

Sacculina rathbunae Boschma

Fig. 5, E

Sacculina rathbuni Boschma, 1933, pp. 222–223, fig. 4 (external cuticle); 1937, pp. 299–300, fig. 74 (male organs and colleteric gland).
Sacculina rathbunae Boschma, 1950, pp. 9–10, fig. 1, d (external appearance).

Type specimen on *Arachnopsis filipes* Stimpson, west coast of Florida.

Material examined.—Los Roques Islands, Venezuela, one specimen on one *Stenorynchus seticornis* (Herbst). Sociedad de Sciencas Naturales La Salle coll. U.S.N.M. 195031.

This new host belongs to the same family (Majidae) and subfamily (Inachinae) as the host of the type specimen.

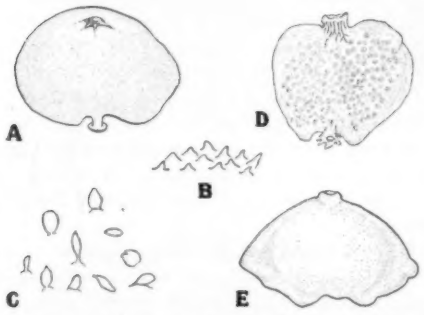

FIG. 5.—A–C, *Sacculina reniformis* Boschma. A, External appearance × 5. B, Excrescences of the external cuticle, surface view. C, Types of retinacula. D, External appearance of *Sacculina pustulata* Boschma × 12. E, External appearance of *Sacculina rathbunae* Boschma × 15.

The parasite is a small one, measuring only 1.5 mm in length, 2.5 mm in breadth and 1 mm in thickness. The dorsal and ventral margins form nipplelike prominences and the term "lozenge-shaped," applied to the type specimen, is also appropriate here.

Sections of this animal revealed that it conforms to the type specimen with respect to the male genital organs. The testes, equal in size, are separate, although in part contiguous and are located in the visceral mass close to the mesentery. They are straight and gradually pass into vasa deferentia, comparatively narrow tubes that also run a straight course.

The colleteric glands are made up of a small number of tubes, 5 to 10 in most sections, arranged in a single row. One gland, however, in the region of maximum division, has 12 tubes forming a double row.

The specimen is a juvenile one, with the mantle cavity appearing as a mere cleft. The sac was still enveloped by the thin chitinous sheath which covers young rhizocephalids previous to the unveiling of the mantle opening. This loose sheath was removed before sectioning the animal and beneath it were found four cypris larvae. They were attached to the inner surface of the sheath near the anterior end. A collection of cypris larvae fixed to a young sacculinid under similar circumstances was observed by Boschma (1931, p. 367) in the case of *Loxothylacus panopei* (Gissler).

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NEMATOLOGY.—*A new nematode*, Rotylenchus melancholicus, *n. sp., found associated with grass roots, and its sexual dimorphism*. LUIZ GONZAGA E. LORDELLO, Escola Superior de Agricultura "Luiz de Queiroz," Universidade de São Paulo, Piracicaba, Brazil. (Communicated by G. Steiner.)

A new species of the genus *Rotylenchus* Filipjev, 1934, was obtained among several hundred other nemas from soil sample submitted for examination and collected at the Escola Superior de Agricultura "Luiz de Queiroz" of the University of São Paulo, Piracicaba, Brazil. This species is of particular interest because of its outspoken sexual dimorphism.

Rotylenchus melancholicus, n. sp.

Male.—Body slightly tapering to anterior extremity and more sharply posteriorly to an elongate and ventrally arcuated tail. Cuticle weakly transversely annulated; lateral fields made up of four incisures extending from the level of the stylet to the tail, being 3.3μ wide at the middle of the body. Head cupolate and practically continuous with neck contour, bearing extremely faint annules. Cephalic and cervical papillae and amphids not seen. Stylet weak and without basal knobs; oesophageal glands well defined, their posterior limit lying at 108μ from the head. Intestinal cells filled with dark and granulated bodies. Testis one, spicules ventrally arcuated and slightly cephalated; gubernaculum curved, well defined. As far as seen, the bursa is represented only by a faint membrane, which does not comprise all the tail. Therefore, the bursa is vestigial and really in process of disappearence. Phasmids very pronounced and located on the middle of the tail or a little in front. Excretory pore located as in the female.

Female.—Body forming a more or less open spiral, slightly tapering at extremities. Cuticle strongly annulated; annules convex. Lateral fields made up of three more or less undulated incisures extending from the region of the stylet to a little below the middle bulb of the esophagus. At that point, the central incisure bifurcates and the fields continue to tail terminus with four equidistant incisures. At terminus, the two external incisures join, as illustrated; location of the union of the two middle incisures not determined. At level of vulva, the lateral fields are 4.3–5.0μ wide. Head cupolate, bearing four post labial annules, continuous with neck contour. Stylet quite strong, very slightly curved, with somewhat compressed knobs. Vestibulum wall thickened, providing well defined guiding tube for stylet and base for attachment of muscles that move the stylet. Tissues surrounding the oesophageal canal with a slight constriction a little in front of the fusion with middle bulb. This bulb is elongate and small, being 9–10μ long and 6–8μ wide. Outlet of dorsal oesophageal gland very obscure, its exact location not made out. Details of junction of oesophagus with intestine also difficult to see. Dorsal gland well developed, overlapping intestine. Its posterior end lies at about 103μ from head end. Intestine opaque; intestinal cells filled with granulated substance. Ovaries two, outstretched, equally developed, each bearing a well defined and spherical receptaculum seminis, usually filled with spermatozoa. Vagina extending almost half way across body. No eggs seen in uterus; oocytes forming a single line, except at the end portion, where a double line is seen. The reproductive apparatus of female of *R. melancholicus* has about the same organization as that figured by Goodey (1940) for *R. erythrinae* (Zimmermann, 1904) Goodey, 1951. Tail ventrally arcuated, comprising from 9 to 10 annules, with a pointed and not annulated terminus. Phasmids located at level of anus or in front.

Measurements.—Male: total length = 422.0–471.5μ; width = 13.3–15.0 μ; stylet = 10.0μ; tail = 25.0–28.0μ; spicules = 18.3–20.0μ; gubernaculum = 8.3μ; a = 31.7; b = ?; c = 16.7–16.8. Female: total length = 514.6–533.0 μ; width = 18.3–21.6μ; stylet = 23.3–25.0μ; tail = 21.6μ; a = 24.6–28.1; b_1 = 7.5–7.6; c = 23.8–24.6; V = 61.6–62.3 percent.

Diagnosis.—The long and deeply ventrally arcuated tail of the male, with only a rudimentary bursa, separates *R. melancholicus* n. sp. from all the other known species. The female has similarities with that of *R. erythrinae* (Zimmermann, 1904) Goodey, 1951, and of *Helicotylenchus nannus* Steiner, 1945.

The separation of the female from *R. erythrinae* can be made by the total length (*R. melancholicus* is a smaller species, 514–533μ: 610–920μ) and by the longer tail (c = 41–64: c = 23.8–24.6); actually, those differences could be considered

insufficient if the male tails were not so diverse. In addition, *R. erythrinae* male has a normal stylet while in *R. melancholicus* this organ is somewhat degenerated. From *H. nannus*, the female of *R. melancholicus* differs by the presence of a receptaculum seminis in the two branches of the amphidelphic sexual apparatus, and by its longer tail (c = 37–41: c = 23.8–24.6).

Type locality.—Grounds of the Escola Superior de Agricultura "Luiz de Queiroz," Piracicaba, State of São Paulo, Brazil, living possibly as parasites of the roots of grasses not identified.

Sexual dimorphism.—The general structure appears to be the only common character of the two sexes. Since the individuals were collected together on the same day and they were the only tylenchids present among hundreds of other nemas, the writer considers them as of the same species.

The male has a longer tail and is smaller, and more slender than the female. The most interesting feature, however, is the degenerated stylet, which in the female is quite strong and possesses very well developed knobs. The visible guiding

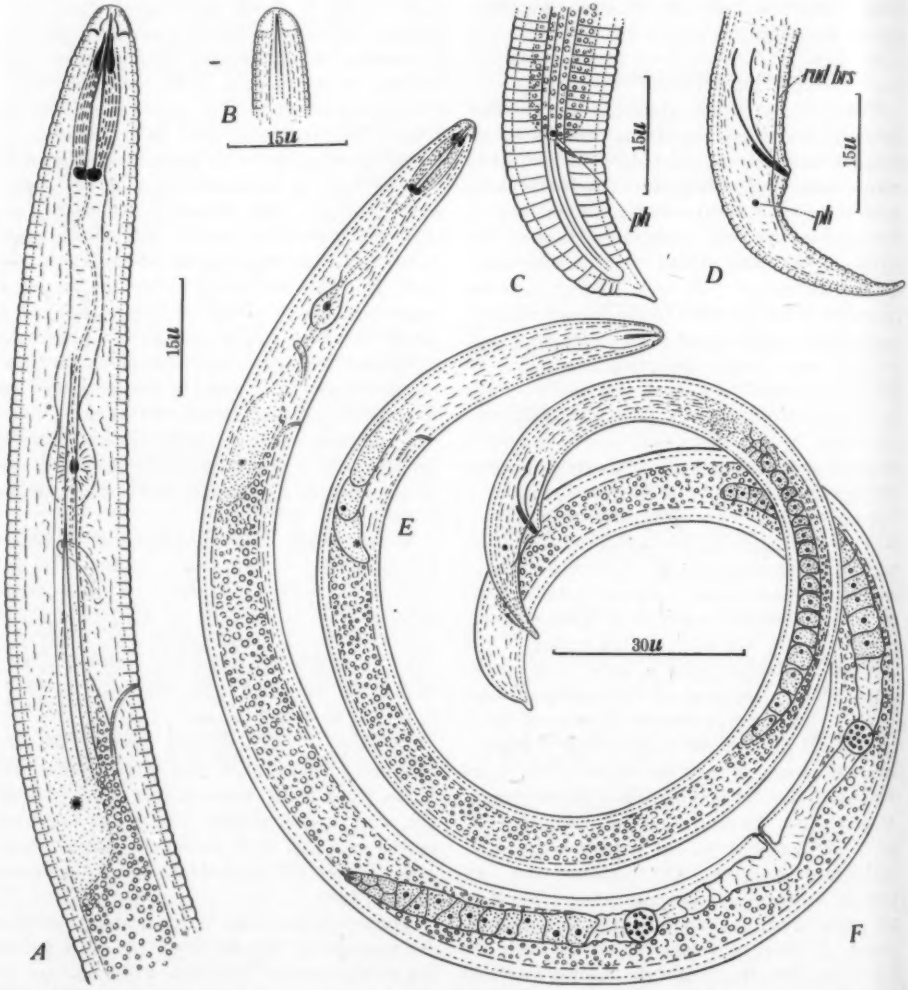

FIG. 1.—*Rotylenchus melancholicus* n. sp.: *A*, esophagus of female; *B*, head of male; *C*, tail end of female (*ph*, phasmid); *D*, tail end of male (*rud brs*, rudimentary bursa; *ph*, phasmid); *E*, male; *F*, female.

case of the female stylet could not be seen in the male, and it is quite possible that it is not present; the protrudor muscles are also much less developed in the latter.

The oesophagus of the male, being very obscure, could not be studied in all the desired details. According to the writer's opinion, the reduced stylet does not mean that the males do not feed during the adult stage, since in one of the individuals of that sex three normal salivary glands were plainly visible. This supposition that the male does not cease to feed after developing into the adult stage is in opposition to what has been supposed for some other tylenchids (e. g., *Nectylenchus abulbosus* Steiner, 1931) (Steiner and Buhrer, 1932).

R. melancholicus males are undoubtly functional, not only for having normal spicules and testis, but also for the presence of abundant spermatozoa filling the female receptaculum seminis.

Another interesting feature of sexual dimorphism may be found in the location of the phasmids which, in the male, are on the tail but, in the female, at level with the anus or a little in front.

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HERPETOLOGY.—Desmognathus planiceps, *a new salamander from Virginia.* WALTER B. NEWMAN, Hyattsville, Md. (Communicated by Doris M. Cochran.)

During the course of herpetological investigations along the southern portion of the Blue Ridge in Virginia a number of very interesting specimens and records were obtained. Among the salamanders collected was a series of 19 *Desmognathus* that possessed such unique characteristics and coloration that I feel that they are justifiably nameworthy and therefore propose that this new salamander be called:

Desmognathus planiceps, n. sp.

Diagnosis.—A large, heavy-bodied *Desmognathus* with the following characteristics: broad, flattened head; spatulate and strongly depressed snout; enlarged and recurved premaxillary teeth in adult males; conspicuous, and normally straight-edged, dorsal band sharply margined with blackish; chest and anterior two-thirds of belly immaculate; chin, throat, and posterior third of belly lightly spotted with brownish-tan.

Holotype.—An adult male collected by Richard L. Hoffman and Walter B. Newman on May 12, 1951, from a portion of the stream (approximate elevation 2800 feet) dropping down into the gorge below the Dan River Dam near Meadows of Dan, Patrick County, Va. This specimen is at present in the personal collection of the author (WBN 1316), but it will eventually be deposited in the U. S. National Museum.

Paratypes.—One topotype, WBN 1318, in addition to the holotype, was collected from the Dan River gorge on May 12, 1951, by Richard L. Hoffman and Walter B Newman. Four topotypes, WBN 1322-4, were collected from this same site by Richard L. Hoffman, Walter B. Newman, and Jaine P. Newman on May 30, 1951.

Five paratypes, WBN 1326-9, 1331, were collected in a mountain stream (approximate elevation 2,400 feet) along Route 8, 5.5 miles northwest of Woolwine, Patrick County, Va., by Richard L. Hoffman, Walter B. Newman, and Jaine P. Newman on May 30, 1951. Eight additional paratypes, WBN 1332-9, were collected from the same locality on August 27, 1951, by Richard L. Hoffman and Walter B. Newman.

Description of holotype.—Snout spatulate; sides of head from anterior corner of eye to angle of jaw nearly parallel; cheeks noticeably swollen; head strongly depressed, sloping abruptly from the eyes to tip of snout; a short vertical groove from angle of jaw to a sinuous groove extending from the eye to the vertical extension of the gular

fold; tip of jaw with pointed mental gland; body broad, heavy, and quite flattened, with a distinct and impressed median dorsal line; tail subquadrate in section near base, becoming slightly keeled above and rounded below posteriorly; posterior half of tail wanting. Legs stout, toes 4–5, those of the forefeet 1-4-2-3 in order of length from shortest to longest, hind feet 1-5-2-3-4; webbing between toes scarcely evident. Tongue roughly diamond-shaped in outline, shortened behind, free at sides and behind, the surface spongy. Vent slightly raised and papillate. Costal grooves 14, counting one each in the axilla and groin; intercostal grooves 4.

All measurements are in millimeters. Tip of snout to anterior angle of vent, 62; tail ?; greatest width of body, 13; greatest height of body, 9; axilla to groin, 36; greatest width of tail, 7; greatest height of tail, 7; tip of snout to gular fold, 17; tip of snout to anterior insertion of forelimb, 20; greatest width of head, 13; width of head measured at anterior angle of eye, 10; eye, measured from anterior to posterior corners, 2.1; forelimb, measured from insertion of limb to tip of longest toe, 11.5; hindlimb, similarly measured, 16; vomerine teeth absent; parasphenoid teeth in two broad patches that meet anteriorly and diverge posteriorly, being nearly uniform in width throughout their entire length.

The dorsum is characterized by a broad, straight-edged, reddish-brown dorsal band, sharply bordered with blackish, that originates on the head slightly anterior to the vertical extension of the gular fold and continues onto the tail, where it becomes abruptly reddish and serrated above the posterior angle of the vent. Irregular brownish-black blotches are present within the band tending to congregate along the

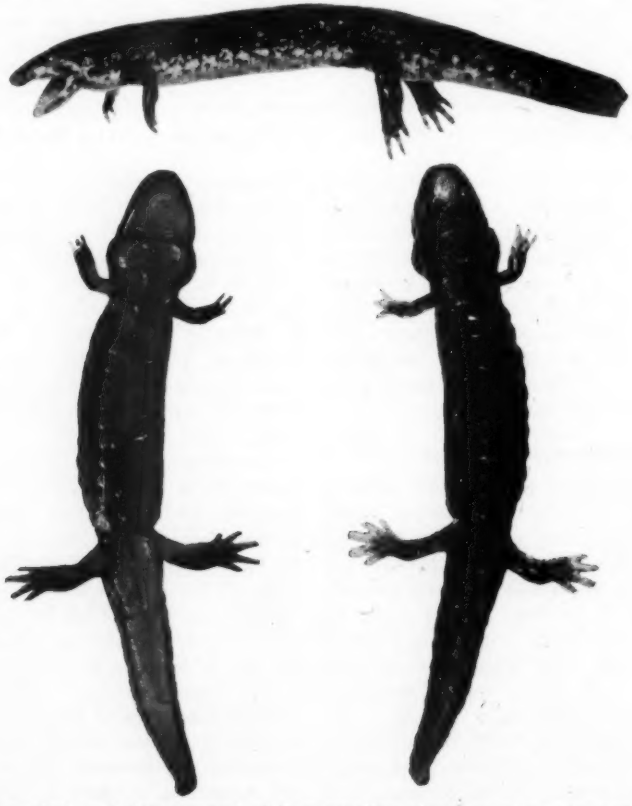

FIG. 1.—Lateral, ventral, and dorsal aspect of *Desmognathus planiceps*, n. sp., type specimen. Photographs courtesy of the Smithsonian Institution.

middorsal line. A pair of conspicuous whitish-yellow spots are present in the outer edge of the band above the insertion of the forelimb. The dorsal surface of the head is reddish-brown up to the eyes, where there is a pronounced line of demarcation between this point and the light tan snout. A conspicuous black spot is centered on the posterior portion of the head. The sides are mottled with brownish and whitish-gray which stops rather abruptly at the outer edge of the belly. Along the sides of the tail there is a row of dark-bordered light spots. The throat is irregularly spotted with tan. The chest is immaculate; the belly immaculate to a point anterior to the hindlimbs, where it becomes lightly spotted with tan.

Variation.—Of the 18 paratypes collected, 12 were marked like the holotype. Of the remaining six specimens, two have a completely spotted ventrum but a typically marked dorsum, whereas three individuals have a grayish-brown mottling that partially or wholly obscures the dorsal band and another has only a few scattered dark spots to indicate this band and lacks much of the heavy mottling along the sides. The latter four specimens all have typically marked ventrums.

All specimens have 14 costal grooves. Intercostal grooves vary from 3 to 5 (average 4) with the larger individuals generally exhibiting the larger number. Vomerine teeth are lacking in large adult males. The largest male with vomerine teeth measures 42 mm in snout-vent length. When present, the number of teeth in males varies from 4 to 13 (mean 8.0). The only two females collected measure 47 and 50 mm in snout-vent length and have 11 and 18 vomerine teeth, respectively. Although only two females were found, counts and measurements do seem to indicate that vomerine teeth are retained in adult females and also that they possess a greater number of teeth than the young males.

Adult males have a distinctly pointed mental gland and this is probably the quickest and easiest method of distinguishing between the two sexes.

Size.—This is one of the larger *Desmognathus* with adult males attaining an estimated total length of 128 mm or more. Unfortunately, the three largest adults, all males, have missing or regenerated tails, and so the extreme total length is an estimated figure based on proportional tail length percentages. The largest specimen with a complete tail measures 120 mm in total length. This specimen has a snout-vent length of 58 mm, while the largest snout-vent measurement of 18 specimens is 63 mm. The smallest individual found has a snout-vent length of 20 mm and a total length of 41 mm. The snout-vent length of the 10 largest adults varies from 47 to 63 mm (mean 55.8 mm).

Remarks.—The spatulate snout, sharply defined dorsal band, and tan spotting of the ventrum separates this species readily from the other large *Desmognathus*, such as *D. quadramaculatus*, and the subspecies of *D. fuscus* and *D. monticola*. The aquatic habits, large size, and heavy body distinquishes *D. planiceps* from the remaining smaller and more terrestrial forms of this genus. *D. planiceps* could be confused with *Leurognathus* because of its flattened head, but the inconspicuous inner naris, compressed tail, and absence of a premaxillary fontanelle of the latter quickly separates the two forms.

D. planiceps, being similar in structure and habits to the more primative forms of *Desmognathus*, presents an interesting evolutionary problem, but I do not consider it to be within the scope of this paper to try to theorize or evaluate the possible relationships that *planiceps* has to the existing known species of this genus. This undoubtedly requires a review of the whole group before a reasonable and sensible picture can be presented properly.

Habits and habitat.—In both localities *D. planiceps* was taken from cool, heavily shaded, mountain streams and was extremely active when discovered. In most instances *D. planiceps* and *D. quadramaculatus* were found to inhabit rocky areas in the shallow, fast-flowing water, while *D. monticola* and *D. fuscus* were more frequently found under rocks and debris along the edges.

Nothing is known of the breeding habits of this species, but a gravid female collected August 27, measuring 47 mm in snout-vent length, contained 19 large, yolk-laden eggs measuring 2 to 4 mm. in diameter.

Range—Apparently restricted to mountain streams in the southern portion of the Blue Ridge in Virginia.

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PROCEEDINGS OF THE ACADEMY

57th ANNUAL MEETING

The 57th Annual Meeting and dinner of the Academy was held at the Kennedy-Warren on the evening of January 20, 1955.

After dinner President DEFANDORF called the meeting to order. The minutes of the 56th Annual Meeting, as published in the JOURNAL **44:** 157–163, May 1954, were approved.

In lieu of the usual reports of officers and committees the President presented a brief summary of the activities of the Academy during the year.

The complete reports of the officers and committee chairman follow:

REPORT OF THE SECRETARY

As of January 1, 1955, the membership of the Academy was 961, a net gain of 28 members during the year. The membership includes 855 active members, of which 675 are resident, 96 retired members, and 10 honorary members. Eleven members resigned, 9 were dropped for nonpayment of dues, and 3 were transferred to the retired list.

The deaths of 17 members were reported to the Secretary since the last Annual Meeting:

ARMIN O. LEUSCHNER, April 22, 1953; FRANCIS E. FOX, December 29, 1953; FRANK WENNER, February 7, 1954; CHARLES L. MARLATT, March 3, 1954; THOMAS P. PENDLETON, May 28, 1954; JAMES S. SIMMONS, July 31, 1954; JOHN C. HUBBARD, August 2, 1954; DAVID FAIRCHILD, August 6, 1954; D. BREESE JONES, September 5, 1954; SAMUEL W. BOGGS, September 14, 1954; NORMAN C. FASSETT, September 14, 1954; GEORGE H. SHULL, September 29, 1954; RAYMOND F. BACON, October 14, 1954; AUSTIN H. CLARK, October 28, 1954; VERA K. CHARLES, November 2, 1954; E. B. BABCOCK, December 8, 1954; and CORNELIUS J. CONNOLLY.

The Board of Managers held nine meetings during the year to transact the regular business of the Academy. A new standing committee, the Committee on Science Education, was authorized and appointed for the purpose of improving the teaching of science in the schools of the metropolitan area (see JOURNAL **44**(12): 403. 1954). The District of Columbia Branch of the American Meteorological Society was affiliated with the Academy by action of the Board at the April meeting.

Seven regular meetings were held during the year in addition to the Annual Meeting as follows:

On February 18, 1954, the speakers were the recipients of the 1953 Academy Awards for Scientific Achievement. BERNARD HORECKER spoke on *An oxidative pathway for the metabolism of carbohydrates;* ROBERT HENRY on *Mechanized production of electronics;* and JOHN R. PELLAM on *Properties of matter at low temperatures.*

The meeting of March 18, 1954, was held jointly with the Washington Branch of the Society of American Bacteriologists. Dr. HENRY WELCH, Department of Health, Education, and Welfare, delivered a lecture on *Antibiotics in 1954.*

On April 15, 1954, the meeting of the Academy was held jointly with the Washington Junior Academy of Sciences. Certificates of Merit were presented to selected high school students. Two talks were given by members of the Junior Academy: *Study in allergy* by MARY JEANNE KREEK, and *Spectrographic determination of intermediate products in catalytic reactions* by ALAN FREDERIC HAUGHT. Dr. WILLIAM F. FOSHAG, U. S. National Museum, Smithsonian Institution, presented an unusually interesting color film and lecture on *The life and death of a volcano.*

The meeting of May 20, 1954, was held at the Army Map Service. The program included a discussion of the Army Map Service and an opportunity to see the Niovac in operation.

On October 21, 1954, members of the Academy were guests of The Johns Hopkins University Applied Physics Laboratory, Howard County, Md. The new building was open for inspection, and a subscription dinner was served prior to the meeting. Dr. RALPH E. GIBSON, director, spoke

on *The objectives of the Applied Physics Laboratory*, SAMUEL N. FONER on *Mass spectrometry of fast reactions*, and RALPH A. ALPHER on *Theories of element origin*.

On November 18, 1954, Dr. KONRAD LORENZ, director, Research Institute for Comparative Ethology, Max Planck Institute, Bulden, Westphalen, Germany, addressed the Academy on *Mechanisms and Releasers in Animal Behavior*.

The meeting of December 16, 1954, was arranged by the Committee on Science Education for a discussion of *Problems of science education*. The speakers were Dr. D. KENNETH LITTLE, deputy Commissioner of Education, U. S. Department of Health, Education, and Welfare, and Dr. DETLEV W. BRONK, President, National Academy of Sciences. Leaders in education in the metropolitan area were guests of the Academy at a dinner preceding the meeting. Each guest was introduced and asked to speak briefly. The dinner was also attended by members of the Board of Managers and the Committee on Science Education.

JASON R. SWALLEN

REPORT OF THE TREASURER

The Treasurer submits the following report concerning the finances of the Washington Academy of Sciences for the year ended December 31, 1954:

RECEIPTS

Dues, 1952	$ 22.00	
1953	198.92	
1954	4,416.25	
1955	92.00	$ 4,729.17
Journal,		
Subscriptions, 1949	6.75	
1950	14.25	
1951	29.25	
1952	36.75	
1953	73.50	
1954	772.89	
1955	762.55	
1956	18.56	1,714.50
Reprints, 1953	544.11	
1954	1,330.84	1,874.95
Sales		532.68
Monograph No. 1		31.90
Forty-year Index		386.25
Directory		1.50
Interest & Dividends,		
1953	49.20	
1954	2,038.50	2,087.70
Junior Academy—Dues		258.00
Science Fair,		
8th	720.00	
9th	500.00	1,220.00
Annual dinner		413.00
Transferred from invested funds		5,000.00
Series G Bonds		4,000.00
Meetings Committee		153.10
Outlawed checks		10.41
Credit memos and overpayments		1.50
Total		$22,414.66
Cash-book balance as of Jan. 1, 1954		5,750.56
Total to be accounted for		$28,165.22

DISBURSEMENTS

	1953	*1954*	*Total*
Secretary's Office		$ 728.51	$ 728.51
Treasurer's Office	$ 20.62	201.60	222.22
Subscription Manager and Custodian of Publications		6.38	6.38
Sales		7.89	7.89
Monograph No. 1		0.92	0.92
Directory,			
34th		2.05	2.05
35th		27.65	27.65
Junior Academy:			
Meetings	17.36	222.00	239.36
Directory		61.25	61.25
Junior Academy Directory		122.50	122.50
Science Calendar		75.00	75.00
Science Education Committee		63.01	63.01
Meetings Committee	66.37	457.04	523.41
Journal			
Printing and Mailing	698.52	5,341.27	6,039.79
Illustrations	73.78	672.86	746.64
Reprints	233.05	914.48	1,147.53
Office:			
Editorial Asst.	40.00	440.00	480.00
Miscellaneous	1.47	30.44	31.91
Science Fair—8th		1,409.74	1,409.74
Forty-year Index		5,987.08	5,987.08

Annual Dinner		358.00	358.00
Transferred to Invested Funds		4,512.40	4,512.40
Debit memos & refunds		11.70	11.70
Totals	$1,151.17	$21,653.77	$22,804.94
Cash-book balance, as of Dec. 31, 1954			5,360.28
Total accounted for			$28,165.22

RECONCILIATION OF BANK BALANCE

Cash-Book Balance, Dec. 31, 1954			$ 5,360.28
Balance as per bank statement		$5,540.52	
Receipts not deposited		53.32	
		5,593.84	
Checks outstanding,			
No. 69	70.00		
No. 86	3.25		
No. 87	160.31	233.56	5,360.28

INVESTMENTS

Potomac Electric Power Co.		
Certificate No. TAO 1977, 40 shares 3.6% pref. @ $43.00		$ 1,720.00
City of New York		
3% (Transit Unification)		
Certificate No.		
D 20186	$500.00	
C 71038	100.00	
C 71039	100.00	
C 71040	100.00	800.00
United States Government		
Series G Bonds: No.		
M 1808741 G	$1,000.00	
M 2226088 G	1,000.00	
M 2982748 G	1,000.00	
M 4126041 G	1,000.00	
M 5141346 G	1,000.00	
M 5141347 G	1,000.00	6,000.00
Massachusetts Investors Trust		
845 shares @ 27.99		23,651.55
Investment Co. of America		
860 shares @ $8.34		7,172.40
State Street Investment Corporation		
108 shares @ $70.00		7,560.00
Washington Mutual Investors Fund		
380 shares @ $14.62		5,555.60
American Security & Trust Co.		
Savings Account		161.52
Total		$52,621.07

Cash-book balance as of Dec. 31, 1954	5,360.28
Total	57,981.35
Total a year ago	50,823.63
Increase	$ 7,157.72

At the close of business December 31, 1954, there were 53 members who were delinquent—a decrease of 6 from the number reported a year ago.

HOWARD S. RAPPLEYE

REPORT OF THE AUDITING COMMITTEE

We the undersigned have audited all the books of the Treasurer and found them completely in order as reported by the Treasurer.

The securities, kept in a safe-deposit box in the vaults of the Union Trust Co., have been examined and found to be as listed in the Treasurer's report. All coupons not yet due are still attached to the bonds so listed.

JOSEPH P. E. MORRISON, *Chairman*
GALEN B. SCHUBAUER
EGBERT H. WALKER

REPORT OF THE ARCHIVIST

The records of the Washington Academy of Sciences in the possession of the Archivist have been maintained status quo during the year just past. They have been available for reference by officers and others concerned. Additional materials turned over to the Archivist during the year by the Secretary are in process of being curated.

JOHN A. STEVENSON

REPORT OF THE BOARD OF EDITORS

Volume 44 of the JOURNAL contains 408 numbered pages, a decrease of 28 pages from volume 43, reflecting the 8 percent decrease in the JOURNAL budget for 1954, which was approved by the Board of Managers. The 69 scientific papers published in Volume 44 include:

Field	*No. Papers*	*No. Pages*
Various phases of zoology	38	123½
Geology and its branches	8	36½
Botany	6	27
Mathematics	5	18
Physics	4	55
Biology	3	22
Anthropology	2	16
Biochemistry	2	20
Biography (scientific)	2	9
Geography and cartography	1	13

As in previous years the number of articles in the physical sciences submitted for JOURNAL publication was small. About 50 percent of the published papers were written by Academy members. The November issue was a special one dedicated to the American explorers Meriwether Lewis and William Clark, in honor of the 150th anniversary of their voyage of discovery. A series of articles, written by specialists upon invitation, appraised the explorers' contributions to several sciences. Proceedings of the Academy for 1953 and 1954 and of the affiliated Anthropological Society, one obituary, and an Index to Volume 44 also were published.

Members of the Board of Editors actively cooperated with the Chairman of President DEFANDORF's Special Committee on the Improvement of the Journal both by supplying facts regarding current editorial policies and procedures and by suggesting ways in which the publication might be improved.

Cost of Volume 44 was as follows:

Disbursements:	
Printing, engraving, mailing etc.	$6,655.43
Reprints (authors separates)	981.57
Editorial office (including postage)	512.13
Total disbursements	$8,149.13
Charges to authors:	1,613.32
Net cost to Academy	$6,535.81

The Board of Editors gratefully acknowledges the help of the Board of Managers, of Mr. PAUL H. OEHSER, managing editor, and of Mr. FRANCIS C. HARWOOD, of the Waverly Press, Inc.

JOHN C. EWERS, *Senior Editor*
RICHARD K. COOK
FENNER A. CHACE

REPORT OE CUSTODIAN AND SUBSCRIPTION MANAGER OF PUBLICATIONS

Once again I am happy to submit in brief form the Annual Report for the year 1954 of the Office of Custodian and Subscription Manager of Publications.

Nonmember Subscriptions

In the United States and possessions	161
In foreign countries	89
Total	250

Although on paper this is a gain of only three over last year's number of subscriptions, actually the gain was greater, as the Treasurer has struck from the list a number of deadwood subscriptions, ones who have not sent in payments for a number of years.

Inventory of stock as of December 31, 1954
Reserve sets of the Journal

Complete sets, vols. 1–44	0 sets
Volumes 11–44	6 sets
Volumes 16–44	14 sets
Volumes 21–44	5 sets
Total sets more or less complete	25 sets

Back numbers of the Journal

Numbers held in complete sets		0
Numbers held in reserve for complete sets		10,305
Numbers held for individual sale		*
Total		*

Proceedings

Complete sets (volumes 1–13)	45 sets

Monograph No. 1

Original issue		1,010
Copies sold or distributed in previous years	212	
Copies sold in 1954	12	
Total sold or distributed	224	224
Number of copies on hand		786

Index to Journal and Proceedings, 1899–1950

Original issue		1,013
Copies sold in 1954	56	
Copies distributed (editor, archivist, subscription manager)	3	
Total sold or distributed	59	59
Number of copies on hand		954

* It was again impossible to make the contemplated recount of these numbers. This will be done this year in connection with the reorganization of the stock.

Sales

During the year 1954 one set, comprising volumes 11–42 was sold to the Library of the Bureau of Entomology of the California Department of Agriculture. In addition, 22 volumes and 71 individual numbers were sold of the Journal, totaling 353 individual numbers. This represents an increase of about 200 numbers sold over those sold last year.

A complete set of the Proceedings and 21 individual numbers were sold during 1954.

Three copies of the Directory were also sold.

There was a continuing though small demand for copies of Monograph No. 1 during 1954. As a matter of fact 12 copies were sold, as compared with 9 sold during 1953. Nevertheless, thought

should be given to increasing the sale of this book, possibly at a reduced price.

As is evident from the figures given above, 56 copies of the Index to the Proceedings and the first 40 volumes of the Journal were sold. Of these 5 were sold to members, 42 directly to libraries, and 9 through dealers. During the first quarter of the coming year (1955) the direct-mailing advertising campaign to sell the Index to libraries, authorized by the Board of Managers, will be initiated.

Once again members were very cooperative in turning back to this office unwanted back numbers of the JOURNAL. For these gifts the Academy is very grateful.

The income from sales of numbers and volumes of the JOURNAL and PROCEEDINGS, including the almost complete set mentioned above, was $532.68, from the Directory, $1.50, from copies of Monograph No. 1, $31.90, and from copies of the Index sold, $386.25. The total income from sales was $952.33, an increase of over $400 over last year's sales.

Expenditures

Supplies	$ 5.88
Expenses in connection with Journal, etc.	9.37½
Expenses in connection with Monograph No. 1	1.64
Expenses in connection with Index	6.36½
Postage used in mailing Directories to new members	3.95
Taxi fares	1.50
Total	$28.71

Storage

Further progress was made in the rearrangement of the stock of numbers of the JOURNAL in the storage room we occupy in the Smithsonian Institution. It is expected that this task will be completed this year, especially since there is the strong possibility that we will have to vacate this room that we have occupied for many years.

HARALD A. REHDER

REPORT OF THE COMMITTEE ON MEMBERSHIP

During the year 1954 the Committee on Membership recommended the nomination of 69 scientists, all of whom were invited to become members by the Board of Managers. To date 38 have become members. This is not a true estimate of new members since it does not include individuals invited and accepting through actions taken late in the previous year, nor does it include those recently acted upon by this Committee. The number of nominations handled by the Committee is a little larger than that for the previous year and testifies to the efficacy of various methods introduced by Dr. Walker during his tenure.

At the beginning of 1954 there were 164 vacancies in the resident membership. There are now 125 vacancies and a total of 675 resident members. Losses in membership for various reasons have made the total gain in resident membership only 29.

Among the 69 nominees physical science fields are represented at the ratio of 54/15 as compared to those of biology. Ninety-eight members were sponsors in this year. Five are members of this Committee. To all these sponsors we are deeply indebted for their contribution to the growth of the Academy.

I wish to thank individually, and as a group, the several members of the Committee on Membership for their work for the Academy during the past year. I wish to thank particularly Drs. Frenkiel and Sanderson who were responsible together for 19 nominations.

It is to be hoped that in the coming year the new President can appoint members to the Committee on Membership from the various areas in which we presently do not have representation. It is sincerely recommended to all members that they exercise their privilege of nominating new members without waiting for suggestion from the Membership Committee itself.

HEINZ SPECHT

REPORT OF THE COMMITTEE ON THE ENCOURAGEMENT OF SCIENCE TALENT

The year was marked by increased participation on the part of the scientific and engineering societies of Washington in stimulating interest in science among young people, particularly those in secondary schools. The Subcommittee on School Contacts worked actively with a parallel committee of the D. C. Council in providing a unified channel of communication between the scientific and engineering societies and the schools. Each school within a 25-mile radius of Washington was assigned to one or more members of the joint committee. These persons kept the schools informed as to lectures and other meetings for young people in the area. When requested they provided speakers and assisted teachers and

students with science projects. After the Science Fair they visited the schools of the winning students to present awards to the students and plaques to the schools.

The success of the Subcommittee's work with the schools was shown by the great increase in the number of students participating in the science fairs of the area and by the very large attendance at lectures for young people. The principal lectures of the year were the Chemical Society Lecture by Dr. STERLING HENDRICKS in February and the two Christmas Lectures of the Philosophical Society by Prof. GEORGE GAMOW.

The main committee worked actively with the young people in the Governing Council of the Junior Academy which was responsible for conducting the Washington Science Fair. The Fair was held at American University on April 9–13, 1954, under the joint sponsorship of Science Service, the Academy and its affiliated societies, the D. C. Council of Architectural and Engineering Societies, and the District of Columbia Board of Education. Funds in the amount of $1,800 were provided by contributions from local societies and individuals. A permanent record of these and other activities was provided in a "Red Book" of the Junior Academy covering the school years 1952–1953 and 1953–1954.

The committee conducted a science talent search for Washington in connection with the thirteenth Westinghouse Science Talent Search. On recommendation of the committee the Academy granted 12 Certificates of Merit, six in recognition of original experimental work, and six for scholarship in science. These awards were presented at a joint meeting of the Academy and the Junior Academy on April 15, 1954, at which some of the winners spoke and others exhibited their projects.

A. T. MCPHERSON, *Chairman*

Awards for Scientific Achievement for 1954 were presented to the following:

In the Biological Sciences, to LEON JACOBS, National Institutes of Health. Introduced by WILLIAM H. SEBRELL, Jr.

In the Engineering Sciences, to W. S. PELLINI, Office of Naval Research. Introduced by EDWARD O. HULBERT.

In the Physical Sciences, to SAMUEL N. FONER, Applied Physics Laboratory, Johns Hopkins University. Introduced by RALPH E. GIBSON.

After the presentation of the Awards, the President introduced Dr. MATTHEW W. STIRLING, director, Bureau of American Ethnology, Smithsonian Institution, who spoke on *Exploring the past in Panama*. The address was illustrated with a color film through the courtesy of the National Geographic Society.

After the report of the Committee of Tellers, the President declared the following persons elected to office:

RALPH E. GIBSON, *President-Elect*
HEINZ SPECHT, *Secretary*
HOWARD S. RAPPLEYE, *Treasurer*
WILLIAM W. RUBEY and JASON R. SWALLEN, *Elected Members of Board of Managers to January 1958.*

The following members of the Academy, nominated by the Affiliated Societies, were elected Vice-Presidents of the Academy:

Philosophical Society of Washington—LAWRENCE A. WOOD
Biological Society of Washington—HERBERT G. DEIGNAN
Chemical Society of Washington—WILLIAM W. WALTON
Entomological Society of Washington—F. W. POOS
National Geographic Society—ALEXANDER WETMORE
Medical Society of the District of Columbia—FREDERICK O. COE
Columbia Historical Society—GILBERT GROSVENOR
Botanical Society of Washington—S. L. EMSWELLER
Washington Section, Society of American Foresters—GEORGE F. GRAVATT
Washington Society of Engineers—HERBERT GROVE DORSEY
Helminthological Society of Washington—JOHN S. ANDREWS
Washington Branch, Society of American Bacteriologists—LLOYD BURKEY
Washington Post, Society of American Military Engineers—FLOYD W. HOUGH
District of Columbia Section, Society for Experimental Biology and Medicine—W. C. HESS
Washington Chapter, American Society for Metals—THOMAS G. DIGGES
Washington Section, International Association for Dental Research—ROBERT M. STEPHAN
Washington Section, Institute of the Aeronautical Sciences—F. N. FRENKIEL
District of Columbia Branch, American Meteorological Society—FRANCIS W. REICHELDERFER

After expressing his appreciation for the cooperation of the members of the Academy during his term of office, Dr. DEFANDORF introduced the incoming President, Dr. MARGARET PITTMAN. She briefly outlined her plans for the coming Academy year and then declared the meeting adjourned.

JASON R. SWALLEN, *Secretary*

473D MEETING OF BOARD OF MANAGERS

The 473d meeting of the Board of Managers, held in the Tayloe Room of the Cosmos Club, June 1, 1954, was called to order by the President at 8 P.M. with the following in attendance: F. M. DEFANDORF, J. R. SWALLEN, J. A. STEVENSON, S. E. FORBUSH, W. A. DAYTON, G. F. GRAVATT, A. H. SCOTT, D. E. PARSONS, F. W. HOUGH, W. C. HESS, F. N. FRENKIEL, and, by invitation, HEINZ SPECHT, R. K. COOK, and KEITH JOHNSON.

Although the meeting was called primarily to elect new members, there was a rather lengthy discussion on science education. It was indicated that the new Committee on Science Education was planning to arrange meetings with school superintendents and science supervisors to discuss problems.

President DEFANDORF stated that he had not yet appointed the special committee to consider means of improving Academy publications, pending selection of a chairman and his acceptance. It was moved and carried that advance approval of the committee to be appointed be given.

474TH MEETING OF BOARD OF MANAGERS

The 474th meeting of the Board of Managers, held in the Tayloe Room of the Cosmos Club, October 19, 1954, was called to order by the President at 8 P.M. with the following in attendance: F. M. DEFANDORF, MARGARET PITTMAN, J. R. SWALLEN, H. S. RAPPLEYE, H. A. REHDER, J. C. EWERS, R. G. BATES, W. W. DIEHL, S. E. FORBUSH, W. H. GILBERT, W. A. DAYTON, L. M. HUTCHINS, G. F. GRAVATT, L. A. SPINDLER, R. S. DILL, E. G. HAMPP, F. N. FRENKIEL, and, by invitation, HEINZ SPECHT, D. J. DAVIS, F. B. SILSBEE, R. K. COOK, and FRANK L. CAMPBELL.

The President announced that the next meeting of the Board would be held on November 9, because the annual birthday dinner meeting of the Cosmos Club would be held on November 16, the regular meeting time.

By reference to the report of FRANK L. CAMPBELL, the President announced the appointment of the Special Committee on the Improvement of the Journal: FRANK L. CAMPBELL, Chairman, S. F. BLAKE, JOHN C. EWERS, F. N. FRENKIEL, C. LEWIS GAZIN, LLOYD G. HENBEST, THOMAS R. HENRY, MARTIN A. MASON, GORDON W. MCBRIDE, ALVIN G. MCNISH, MARGARET PITTMAN, B. F. SCRIBNER, J. FRANKLIN YEAGER, AND L. E. YOCUM.

Dr. DAVIS stated that the November meeting would be held jointly with the Biological Society of Washington, with Dr. KONRAD Z. LORENZ as the speaker, and the December meeting would be a general discussion of problems of science education, with Dr. D. W. BRONK and Dr. SAMUEL H. BROWNELL as principal speakers.

In the absence of Dr. MCPHERSON, the President read part of a report of a meeting of the Committee on the Encouragement of Science Talent. This was primarily a planning meeting, and the results will be reported to the Board at a later date.

Dr. FRANK L. CAMPBELL, chairman of the Special Committee on the Improvement of the Journal, presented a progress report which had been submitted to the Committee on Policy and Planning. The following recommendations were made by the special committee:

In order to fix responsibility and gain continuity of effort for the rehabilitation of the JOURNAL it is recommended that an Editor, having full authority for the execution of policy, be nominated by the Board of Managers and elected by the members of the Academy and that the Editor continue to serve as long as it is agreeable to him and to all concerned, as indicated by annual renomination by the Board and reelection by the members of the Academy. Note that amendment of the Bylaws would be required to effect this recommendation.

In order to give the Editor assistance in solicitation of manuscripts, or the direction of solicitation, it is recommended that three Associate Editors be elected annually by the Board of Managers, without limitation as to the possibility of reelection. Again, amendment of the Bylaws would be required to effect this recommendation. It is suggested that each of the Associate Editors be given specific responsibilities; e.g., one for obtaining short original manuscripts, another for obtaining or preparing manuscripts on the progress of science, the third for obtaining or preparing local news copy.

In order to multiply editorial awareness of the existence of suitable material for the JOURNAL and the number of solicitations that can be made to obtain it, it is recommended that Correspondents, one for each society affiliated with the Academy, be nominated by the affiliated societies and elected by the Board of Managers. Directed by the Editor or an Associate Editor, a Correspondent would solicit manuscripts for the JOURNAL from members of his society and would report the programs, significant proceedings, and other news of his society to the Editor. It is not necessary that a Correspondent be a member of the Academy.

In order to extend the news-gathering net of the JOURNAL it is recommended that additional Correspondents be nominated and elected by the Board of Managers to serve the Editor in each of the large scientific research institutions of the Washington metropolitan area. If the institution has a press service or public relations office, the Correspondent would serve to screen news releases for the use of the JOURNAL. He would also assist in soliciting manuscripts in his institution.

In order to diminish the reluctance of experimental scientists to publish the results of their original work in the *Journal* it is recommended (1) that the Editor be authorized and instructed to adjust charges for reprints to cover extra costs involved in setting up special kinds of material, (2) that the JOURNAL be exchanged with other scientific journals at the discretion of the Editor.

In line with recommendation (1), it was moved and carried that the Editor be authorized and instructed to adjust charges for reprints to cover extra costs involved in setting up special kinds of material.

There was considerable discussion of (2), on the exchange of the JOURNAL with other scientific journals, but no definite action was taken.

It was suggested that the work of the special committee be continued by the subcommittee on ways and means.

The Secretary reported the death of the following members, noted since the last meeting of the Board in June: CHARLES L. MARLETT, on March 3; THOMAS P. PENDLETON on May 28; JAMES S. SIMMONS on July 31; JOHN C. HUBBARD on August 2; and SAMUEL W. BOGGS on September 14. A letter from Dr. W. J. V. OSTERHOUT was read requesting that he be placed on the retired list. His request was approved effective as of December 31, 1954.

Mr. RAPPLEYE presented the request of JAY P. KINNEY to be placed on the retired list. This was approved effective as of December 31, 1954. He reported that he had already received two contributions for the Science Fair.

Dr. REHDER reported that all complete sets of the JOURNAL had been sold. He was authorized by the Board to purchase complete sets not to exceed $200 a set.

475TH MEETING OF BOARD OF MANAGERS

The 475th meeting of the Board of Managers, held in the Tayloe Room of the Cosmos Club, November 9, 1954, was called to order by the President at 8 P.M. with the following in attendance: F. M. DEFANDORF, MARGARET PITTMAN, J. R. SWALLEN, H. S. RAPPLEYE, J. A. STEVENSON, J. C. EWERS, R. G. BATES, R. J. SEEGER, S. E. FORBUSH, W. A. DAYTON, F. W. POOS, W. C. HESS, J. G. THOMPSON, F. N. FRENKIEL, and, by invitation, HEINZ SPECHT, F. B. SILSBEE, and FRANK L. CAMPBELL.

President DEFANDORF stated that the Committee on Grants in Aid was preparing recommendations, and the chairman, Dr. EATON, would probably present them at the next meeting of the Board.

Dr. SEEGER, chairman of the Committee on Science Education, reported that the committee had held its third meeting. He stated that it was marking time for the present, pending facts and data that are rather difficult to obtain. It was hoped that something more tangible would result from the December meeting of the Academy.

In the absence of Dr. Read, acting chairman of the Committee on Encouragement of Science Talent, the President read the following report of the committee:

It is becoming increasingly evident that the work of the Committee is a part of a wide and general movement both in Greater Washington and throughout the nation to increase the number of young people in careers in the sciences and their applications.

The particular concern and responsibility of this committee is the Washington Junior Academy of Sciences and the science fairs which are now sponsored by this organization.

The Junior Academy has made a good beginning in the current year. There have been several meetings of the Governing Council of this organization, and one is being held on this date, which accounts for the absence of the acting chairman of your committee.

Plans have been made for the year's program. Two meetings of the Junior Academy have been held. The first, attended by around seventy, was addressed by Dr. Youden of the National Bureau of Standards. The second was the annual "Projects Meeting" at which some fifteen scientists and

engineers met with approximately two hundred students and their guests to plan and discuss projects for the science fairs in the spring.

Future meetings will include: a session at Wilson Teachers College, devoted to the work of science teachers; the Christmas Lectures supported by the Philosophical Society; a meeting at the Beltsville Laboratories of the Department of Agriculture; probably a trip to the Franklin Institute of Philadelphia; the Awards Program in connection with the Senior Academy; and a meeting at which the winners of various contests and fairs will discuss their projects.

The schools of Prince Georges County plan a science fair with a view of separate representation at the National Science Clubs annual science fair. It is also planned to have more small fairs in the individual schools and to send only the better exhibits to the final large fair, which will probably be held in the gymnasium of the McKinley High School.

Letters have been sent by the President of the Washington Academy to all organizations affiliated with the Washington Academy of Sciences and the District of Columbia Council of Engineering and Architectural Societies, asking that budget plans include support for the Annual Science Fairs.

The Education Committee of the District Council is working with Dr. Arnold Scott's subcommittee of the Academy in an extensive program aimed at arousing greater interest among students and their parents in science and mathematics and their applications. At a recent meeting of the District Council, Chairman Higginson made a very encouraging report indicating not only increased interest on the part of engineers, but a still greater degree of cooperation with the Academy in this program.

While not the immediate responsibility of your committee, there are several other phases of this broad program that should be included in this report.

On September 23 there was a conference under the auspices of the Future Scientists of America Foundation to plan the 1955 program of this organization. The Foundation is a part of the National Science Teachers Association and is closely affiliated with the National Education Association. There was an attendance of around 100, including not only educators and representatives of such organizations as the U. S. Office of Education and the Scientific Manpower Commission, but a number of people from professional societies and from large industries. The principal theme of this conference was the improvement of science teaching.

The Engineering Manpower Commission maintains a large and active Guidance Committee which operates on a regional basis. As the committee member from the District of Columbia, your acting chairman attended the annual conference of Region III, which includes Pennsylvania, Maryland, Delaware, and the District of Columbia. The major interest of this regional committee by common consent is the effort to inform and interest secondary school students. While approaches differ with local situations there appears to be real unanimity of purpose.

A large number of people in Greater Washington have become interested in having an educational television station here, which is to be free of commercial sponsorship. An organization has been formed with institutional members, a board of trustees, and representatives from all sorts of clubs and societies. Plans of the Board of Trustees include a modest two-year program of education which would use programs on local stations before a final campaign for funds for a new station. Seven cities are operating such stations and a dozen more expect to. It would be well for each society affiliated with the Academy and the District Council to add to the duties of their separate educational representatives the responsibility for following the plans and progress of the Greater Washington Educational Television Association.

Dr. CAMPBELL, chairman of the Special Committee on the Improvement of the JOURNAL, stated that he had met with Messrs. Ewers, Frenkiel, and Scribner to consider changes that might be made and the timing of them. It was indicated that some changes could be made in the JANUARY issue along lines of information about local scientists and scientific institutions.

The Secretary read the following report of the Nominating Committee:

The Nominating Committee, consisting of the Vice-Presidents of the Academy, met in the Tayloe Room of the Cosmos Club on Tuesday, October 19, 1954. The meeting was called to order at 10 P.M. by S. E. Forbush, who presided. Others present were: W. H. Gilbert, W. A. Dayton, Lee M. Hutchins, G. F. Gravatt, L. A. Spindler, Richard S. Dill, E. G. Hampp, and F. N. Frenkiel.

The nominees selected for the offices to be filled by balloting by members in December were as follows:

For President-Elect—RALPH E. GIBSON
For Secretary—Heinz Specht
For Treasurer—Howard S. Rappleye
For the Board of Managers to serve January 1955 to January 1958 (two to be elected): W. W. Diehl, Frank C. Kracek, W. W. Rubey, Jason R. Swallen.

The deaths of the following members of the Academy were reported: David Fairchild on August 6, D. Breese Jones on September 5, George H. Shull on September 29, Norman C. Fassett on September 14, Raymond F. Bacon on October 14, Austin H. Clark on October 28, and Vera K. Charles on November 2.

Mr. Rappleye reported that eight contributions amounting to $250.00 had been received for the Science Fair.

Dr. Frenkiel announced that the Christmas Lectures of the Philosophical Society would be given on December 22 and 23, and the speaker would be Dr. George Gamow.

476TH MEETING OF BOARD OF MANAGERS

The 476th meeting of the Board of Managers, held in the Tayloe Room of the Cosmos Club, December 21, 1954, was called to order by the President at 8 P.M. with the following in attendance: F. M. DEFANDORF, MARGARET PITTMAN, J. R. SWALLEN, H. S. RAPPLEYE, J. A. STEVENSON, W. W. DIEHL, M. A. MASON, R. J. SEEGER, A. T. MCPHERSON, S. E. FORBUSH, W. A. DAYTON, F. W. POOS, A. WETMORE, A. H. SCOTT, D. E. PARSONS, F. W. HOUGH, W. C. HESS, E. G. HAMPP, F. N. FRENKIEL and, by invitation, R. C. DUNCAN, H. N. EATON, F. W. SILSBEE, R. K. COOK, FRANK L. CAMPBELL, H. M. TRENT, B. J. OLSON, F. C. KRACEK, KEITH JOHNSON, and WATSON DAVIS.

President DEFANDORF announced the appointment of Dr. HAROLD E. FINLEY to the Committee on Encouragement of Science Talent, to serve to January 1956 to complete the unexpired term of AUSTIN CLARK. Dr. M. A. MASON and Dr. ROGER BATES were appointed to represent the Academy on the Committee on Engineering Recognition of the District of Columbia Council of the Engineering and Architectural Society.

In the absence of Dr. DORLAND DAVIS, chairman of the Committee on Meetings, Dr. Wetmore reported that the speaker at the annual dinner meeting, to be held at the Kennedy-Warren, would be Dr. Matthew W. Stirling, director of the Bureau of American Ethnology, who would talk about his explorations in Panama. Arrangements have been made with the National Geographic Society to show one of their films taken by Dr. Stirling to illustrate the lecture.

There was much discussion on the content of the rest of the program for the dinner meeting. It was unanimously approved that reports would be read by title only with the exception of the Treasurer's report and the report of the Auditing Committee, and the President would briefly review the activities of the Academy during the year. The Awards for Scientific Achievement would be presented, but the recipients would not be expected to speak either at the annual meeting or subsequently at a later meeting.

ROBERT C. DUNCAN, chairman of the Committee on Awards for Scientific Achievement, asked the Chairmen of his subcommittees to present nominations for the awards.

For the award in the Biological Sciences, Dr. BYRON J. OLSON presented the nomination of LEON JACOBS in recognition of his distinguished contributions to the field of parasitology. In the Engineering Sciences, Dr. HORACE M. TRENT presented the nomination of W. S. PELLINI in recognition of his notable contributions in the field of metals processing. In the Physical Sciences, Dr. F. C. KRACEK presented the nomination of SAMUEL N. FONER, in recognition of his studies of constituents of flame reactions, and specifically for his direct experimental discovery and proof of the existence of the HO_2 radical in certain types of flames.

These nominations were approved by the Board.

Reporting for the Subcommittee for the Teaching of Science, Dr. M. A. MASON stated:

> The committee invited nominations from the heads of all educational institutions and school systems in the Metropolitan area, and received detailed information on seven nominees.
>
> The committee concludes on the basis of data available to it that no recommendation should be made for an award this year.
>
> The committee wishes to call attention to the service to young science students provided by Miss Margaret Patterson of Science Service in her guidance of Science Clubs of America and other services. It has been suggested to the committee that some recognition of Miss Patterson's contributions might be appropriate for the Academy. The committee is aware that Miss Patterson is not eligible for any existing award of the Academy. The committee believes several persons in addition to Miss Patterson may have contributed substantially to encouragement of science talent, and therefore recommends that the Governing Council of the Junior Academy of Sciences be asked to inform the Board of Managers on the desirability and a mechanism of recognizing such contributions.

Dr. EATON, chairman of the Committee on Grants-in-Aid for Research, reported that no applications had been received for a grant, although various educational institutions had been informed that they were available. It was recommended that the allotment for the current year from the A.A.A.S. be added to that to be received next year.

Dr. F. B. SILSBEE, chairman of the Committee

on Policy and Planning, presented the following report:

We have given careful consideration to the interim report dated October 12, 1954, of the Special Committee on the Improvement of the Journal of the Washington Academy of Sciences, of which Dr. Frank L. Campbell was chairman, and discussed it at length at a meeting held December 14. In general we agree with its recommendations and look forward to receiving its further suggestions concerning ways and means.

We feel that the Journal should be aimed at being interesting, informative and useful to its readers rather than, as at present, of primary usefulness to its authors by providing a medium for prompt publication of their original scientific work. The Journal should be a medium for interpreting 'Science in Washington' to the nation and to the world.

As indicated in the discussions of the Special Committee, articles fall into one or another of three main types: (1) short or long articles of general interest which may be either discussions of problems common to different branches of science, for example manpower, governmental programs, basic trends, or survey articles presenting current developments in rather broad fields of science for the information of workers in other fields; (2) short papers announcing original discoveries by scientific workers in Washington; and (3) local items of importance but relatively transient interest connected with scientific life in Washington. Our committee feels that the relative importance of these types of articles is that in which they are listed above rather than that implied by the recommendation on page 2 of the October 12 report of the Special Committee.

It is obviously desirable that the short articles of category (2) announcing original scientific work should, if possible, be distributed over a much wider range of scientific disciplines than is usually the case at present. However, merely spreading the range of this type of paper would not really solve the main problem. It would mean that the chances that any individual member of the Academy would find something of interest in a given issue of his Journal would be definitely increased but his interest would still be stimulated by only a very small fraction of the whole magazine.

Our committee is in hearty agreement with the Special Committee that it would be wise to fix responsibility and gain continuity of effort in the operation of the Journal by assigning its conduct primarily to a single editor who would have full authority for the execution of policy, and who would normally be expected to continue to serve for a number of years. We also agree that such an officer should be supported by a group of perhaps three associate editors. The selection of these individuals will require careful consideration and negotiation which could best be done by a relatively small group. Our committee therefore recommends that the editor be nominated by the Executive Committee of the Academy and elected by the Board of Managers and that the associate editors be similarly nominated by the Executive Committee in consultation with the editor and also elected by the Board of Managers. The election by the Board of Managers would permit the prompt filling of vacancies and avoid the delay and expense required by an election from the Academy membership as a whole. We feel that this advantage more than offsets the slight additional stature which might accrue to the editors if they were elected by the membership as a whole.

Our committee is inclined to question the effectiveness of the suggested corps of correspondents in the affiliated societies, although we do concur that such a liaison with the major scientific institutions of the city might be very helpful. Presumably the development of such relationships can be left to the discretion of the new board of editors.

Our committee discussed briefly the possible desirability of paying the editor an honorarium. This in part might offset possible rather unofficial expenses (lunches with prospective authors, etc.) which he might find it desirable to incur and also might perhaps stimulate in him a more concrete sense of responsibility than if his services were entirely a 'labor of love.' We feel, however, that this matter should be left to the discretion of the Executive Committee of the Academy.

Our committee does not feel that a possible gain in circulation resulting from an exchange with other scientific journals would offset the probable loss of a number of paid subscriptions and the bother and confusion of handling the journals received in exchange.

The establishment of the new form of the Board of Editors will require amendments to the By-laws and amendments suitable to effect this are attached hereto for consideration by the Board of Managers.

The proposed amendments to the Bylaws were then presented. They were approved by the Board and the Secretary instructed to submit them to the members of the Academy for a ballot vote. The proposed amendments are as follows:

ART. III, Sec. 1—First sentence, after "Treasurer" insert "an Editor." Second sentence, delete "the Senior Editor."

ART. III, Sec. 5—Revise by substituting:

"The Board of Editors shall consist of the Editor and three Associate Editors. The Editor shall be elected annually by the Board of Managers on nomination of the Executive Committee of the Academy. The Associate Editors shall be elected annually by the Board of Managers on nomination by the Executive Committee of the Academy acting in consultation with the Editor. Vacancies occurring during the year shall be filled in the same manner."

ART. IV, Sec. 3—Change "Board of Editors" to "Editor."

ART. IV, Sec. 5—Revise by substituting:

"The Editor shall have charge of the Journal of the Academy and shall sign all contracts on behalf of the Journal."

ART. V, Sec. 1—Change "Board of Editors" to "Editor."

Dr. MCPHERSON reported that the members of the Junior Academy were honor guests at the Christmas lectures of the Philosophical Society. Also that the Junior Academy was sponsoring a visit to the Franklin Institute.

Dr. SEEGER, chairman of the Committee on Science Education reported that letters would be sent to all Academies requesting data as to what other Academies are doing about the problem of science education.

The Secretary reported the deaths of E. B. BABCOCK on December 8, 1954, and CORNELIUS J. CONNOLLY.

The Treasurer reported that $415 had been received so far for the Science Fair.

The problem of financing the attendance at the National Science Fair by winners of the local Science Fair was presented by KEITH JOHNSON. This was brought about by the fact that the Washington Daily News, which has sponsored participation in the National Science Fair, had withdrawn its support. Although several ideas were suggested and freely discussed, no solution seemed to be immediately available.

JASON R. SWALLEN, *Secretary*

NEW MEMBERS OF THE ACADEMY

There follows a list of persons elected to membership in the Academy, by vote of the Board of Managers, since November 17, 1953, who have since qualified as members in accordance with the bylaws (see also this JOURNAL **44:** 128–132. 1954).

RESIDENT

Elected November 17, 1953

WILLIAM H. ANDERSON, assistant chief, Division of Insect Detection and Identification, Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, in recognition of his contributions to our knowledge of the systematics of the insect order Coleoptera as indicated by studies of the immature stages.

HERMAN BOGATY, research associate, Harris Research Laboratories, in recognition of his extensive investigations in cellulose and keratin chemistry involving their chemistry and properties.

CHARLES O. HANDLEY, Jr., assistant curator, Division of Mammals, U. S. National Museum, in recognition of his contributions to the field of systematic mammalogy, particularly in the American Arctic, Virginia, Guatemala, and Southwest Africa.

Elected December 14, 1953

STEWART R. COOPER, professor of analytical chemistry, Howard University, in recognition of his work in analytical chemistry, and particularly his researches in the field of polarography.

HENRY HOPP, biometrician, Foreign Agricultural Service, U. S. Department of Agriculture, in recognition of his contributions in the fields of forestry, soils, and agricultural experimentation, with notable achievements in the application of biometry to the development of agricultural experimentation and extension in underdeveloped countries.

VICTOR J. TULANE, associate professor of chemistry, Howard University, in recognition of his work as a teacher and research man in the field of biochemistry, and particularly for his work dealing with automatic increase of solvent polarity in chromatographical analysis.

Elected January 11, 1954

ERNESTINE B. THURMAN, entomologist, Division of International Health, U. S. Public Health Service, in recognition of her contribution to the taxonomy and biology of bloodsucking insects, particularly the mosquitoes of North America.

SIDNEY H. LIEBSON, head, Electromagnetics Branch, Naval Research Laboratory, in recognition of his contributions in the fields of gaseous discharges, organic fluorescence, and solid state physics.

DONALD B. MCMULLEN, chief, Department of Medical Zoology, Army Medical Service Gradu-

ate School, Walter Reed Army Medical Center, in recognition of his contributions in the field of medical zoology, particularly on the epidemiology and control of schistosomiasis.

HENRY S. FULLER, assistant chief, Department of Entomology, Army Medical Service Graduate School, Walter Reed Army Medical Center, in recognition of his research in the field of medical entomology, including the use of arthropods as laboratory hosts of experimental infection, and on the epidemiology of arthropod-borne diseases.

CARL O. GRASSL, botanist, Division of Sugar Plant Investigations, U. S. Department of Agriculture, in recognition of his important taxonomic studies on sugarcane and its wild allies, and important contributions to sugarcane genetics, including the breeding of disease resistant varieties.

Elected February 16, 1954

DONOVAN S. CORRELL, botanist, Plant Introduction Section, U. S. Department of Agriculture, in recognition of his contributions to taxonomic and economic botany, especially his work on ferns and orchids.

GEORGE GAMOW, professor of theoretical physics, George Washington University, in recognition of his numerous contributions to astrophysics, cosmology, and nuclear physics.

WALTER H. HODGE, assistant head, Plant Introduction Section, U. S. Department of Agriculture, in recognition of his contributions to taxonomic and economic botany, especially his work on the flora of Dominica.

HARRY POLACHEK, chief, Applied Mathematics Laboratory, David Taylor Model Basin, in recognition of his contribution to mathematics and, in particular, to the application of high-speed computing techniques in theoretical fluid dynamics.

HARRY WEXLER, chief, Scientific Services Division, U. S. Weather Bureau, in recongition of his contribution to meteorology and, in particular, to synoptic and dynamic meteorology and to solar and atmospheric radiation.

Elected April 20, 1954

JOHN A. BENNETT, chief, Mechanical Metallurgy Section, National Bureau of Standards, in recognition of his contributions to physical metallurgy, particularly for his studies of the causes and mechanism of fatigue failures in metals.

ELBERT DECOURSEY, director, Armed Forces Institute of Pathology, in recognition of his contributions to the pathology of atom-bomb injuries.

FRANCIS E. ELLIOTT, oceanographer, U. S. Navy Hydrographic Office, in recognition of his contributions to the geography of the oceans and to the physical characteristics of the inshore environment.

HAROLD E. FINLEY, head, Department of Zoology, Howard University, in recognition of his services as teacher and investigator in zoology, and in particular his work on sexual patterns in ciliates.

E. R. KENNEDY, assistant professor, Department of Biology, Catholic University of America, in recognition of his contributions to bacteriology and immunology and in particular his researches on quantitative aspects of the gram reaction.

MORRIS C. LEIKIND, chief, Historical Research Division, Medical Museum, Armed Forces Institute of Pathology, in recognition of his contributions to the history of science, particularly in the fields of bacteriology and medicine.

RUSSELL W. MEBS, physicist, National Bureau of Standards, in recognition of his contribution to physical metallurgy, particularly for his researches on elastic properties of metal, flow and fracture of metals, and ultrasonic properties of metals.

KELSO B. MORRIS, associate professor, Department of Chemistry, Howard University, in recognition of his services as a teacher of chemistry on a university level, and particularly his work on the oxidation of hydroxylamine.

DAVID MCK. RIOCH, technical director, Neuropsychiatry Division, Army Medical Service Graduate School, Walter Reed Army Medical Center, in recognition of his contributions to neurology and psychiatry.

MERRITT P. SARLES, associate professor, Department of Biology, Catholic University of America, in recognition of his work in experimental parasitology, and especially his contributions to our knowledge of the mechanisms of immunity to parasitic nematodes.

Elected May 18, 1954

VICTOR R. BOSWELL, head, Section of Vegetable Crops and Diseases, U. S. Department of Agriculture, in recognition of his contributions to horticultural science and in particular his researches on the production, physiology, and breeding of vegetable crop plants.

ELIAS BURSTEIN, head, Physics Section, Crystal Branch, Naval Research Laboratory, in recognition of his contribution to solid state physics and in particular his work on optical investigations of semiconductors and on color center formation in crystals.

J. L. ERICKSEN, head, Theoretical Mechanics Section, Naval Research Laboratory, in recognition of his outstanding researches in continuum mechanics, especially his discoveries in nonlinear elasticity and in the theory of invariance fundamental to modern nonlinear continuum mechanics.

HERBERT FRIEDMAN, head, Electron Optics Branch, Optics Division, Naval Research Laboratory, in recognition of his outstanding research in the fields of X-rays and Geiger counters which has culminated in his discovery that X-rays are present in the radiation from the sun with intensity sufficient to account for E-layer ionization.

B. L. HORECKER, chief, Section on Enzymes and Metabolism, National Institute of Arthritis and Metabolic Diseases, National Institutes of Health, in recognition of outstanding original work in enzymatic mechanisms.

LAWRENCE M. KUSHNER, physical chemist, National Bureau of Standards, in recognition of his work on colloidal systems, in particular the size and shape of micelles by means of viscometric and light-scattering studies.

JOHN R. MAGNESS, head, Fruit and Nut Crop Investigations, U. S. Department of Agriculture, in recognition of his contributions to horticultural science and in particular his researches on the physiology of fruits during picking, packing, shipping, and storage.

MELVIN R. MEYERSON, metallurgist, National Bureau of Standards, in recognition of his contributions in the field of physical metallurgy, particularly in his studies of the transformations that occur in solid steels and of the mechanism of the fracture of metals in laboratory tests and under service conditions.

ALBERT W. SÁENZ, physicist, Applied Mathematics Branch, Naval Research Laboratory, in recognition of his researches in elasticity and relativity, especially his fundamental work on moving discontinuities in elasticity and his important simplification of two of Hlavaty's fundamental theorems in unified field theory.

OLGA TAUSSKY (Mrs. John Todd), consultant in mathematics, National Bureau of Standards, in recognition of her contributions to pure mathematics, notably to algebra and number theory.

Elected June 1, 1954

MILTON ABRAMOWITZ, assistant chief, Computation Laboratory, National Bureau of Standards, in recognition of his contributions to applied mathematics, particularly the theory of special functions, fluid mechanics, and mathematical tables.

RICHARD B. BLACK, operations analyst, Office of Naval Research, in recognition of geographical exploration as commander of East Base, U. S. Antarctic Service Expedition 1939–41, and pioneering colonization activities in American Equatorial Islands for the Interior Department.

FLOYD W. BUCKLEY, physical chemist, National Bureau of Standards, in recognition of his contributions to physical chemistry, and in particular his significant research papers on the fundamental equations of thermodynamics, the theory of polarographic measurements, and dielectric properties of substances.

GEORGE DICKSON, physicist, Dental Research Section, National Bureau of Standards, in recognition of his research on dental restorative materials and on tooth structure.

W. B. EMERSON, physicist, National Bureau of Standards, in recognition of his contributions in the field of applications of interferometry to metrology.

IRVIN H. FULLMER, chief, Engineering Metrology Section, National Bureau of Standards, in recognition of his work in engineering metrology, length measurements by optical interference methods, promotion of the international unification of screw thread, and other standards.

DONALD C. MAY, Jr., mathematician, Bureau of Ordnance, Navy Department, in recognition of his significant contributions to the development of the mathematical theory of the field of ships, and to the theory of weapon systems.

CHARLES R. NAESER, chemist, U. S. Geological Survey, in recognition of his work in inorganic chemistry, particularly the rare earths.

SANFORD B. NEWMAN, microanalyst, National Bureau of Standards, in recognition of his contributions in microscopy and fiber technology, in particular his work in ultramicrotomy that led to the extensive use of electron microscopy in the study of biological and fibrous materials.

J. SAMUEL SMART, research physicist, Magnetics Branch, Solid State Division, Naval Ordnance Laboratory, in recognition of his contribution to the problem of the detection of antiferromagnetism by means of neutron diffraction

and for his advancement of our understanding of ferromagnetism.

PAUL L. SMITH, consultant, Crystal Branch, Naval Research Laboratory, in recognition of his contribution to crystal physics, in particular his work on piezoelectricity and piezoelectric materials.

ROBERT E. STEPHENS, physicist, Optical Instruments Section, National Bureau of Standards, in recognition of his contributions in the field of lens design and optical instruments.

WILLIAM T. SWEENEY, chief, Dental Research Section, National Bureau of Standards, in recognition of his contributions in the field of dental materials and especially for his research with plastics used in dentistry.

JOHN L. TORGESEN, chemist, National Bureau of Standards, in recognition of his contributions in the field of physical chemistry, especially the measurement of fundamental physical properties of pure substances.

Elected October 19, 1954

DANIEL P. JOHNSON, physicist, Mechanical Instruments Section, National Bureau of Standards, in recognition of his contributions to the precise measurements of pressure ranging from those arising from small fluctuations in air pressure to the highest pressures used in chemical processes and in internal ballistics.

Elected November 9, 1954

H. P. BROIDA, physicist, Temperature Measurements Section, National Bureau of Standards, in recognition of his contributions to spectroscopy, and in particular his research on temperature measurements in flame.

PETER CHRZANOWSKI, physicist, Sound Section, National Bureau of Standards, in recognition of his contributions to acoustical measurements, particularly the measurement of sound absorption and transmission by acoustical materials and the propagation of sound in very low frequencies.

WILLIAM R. DURYEE, zoologist, Department of Terrestrial Magnetism, Carnegie Institution of Washington, in recognition of his fundamental studies of the nucleus of living cells.

JAMES B. SAUNDERS, physicist, National Bureau of Standards, in recognition of his contributions in the field of high precision measurements, particularly in thermal expansion and the quality of optical surfaces.

A. M. STONE, technical assistant to the director, Johns Hopkins University Applied Physics Laboratory, in recognition of his contributions to operational research in the field of guided missiles.

CARLETON R. TREADWELL, professor of biochemistry, George Washington University School of Medicine, in recognition of his studies on cholesterol metabolism and relation to atherosclerosis.

NONRESIDENT

Elected February 16, 1954

J. DAMPÉ DE FÉRIET, professeur à la faculté des sciences de l'Université de Lille, France, in recognition of his contribution to mathematics and fluid dynamics and, in particular, to the theory of stochastic processes as related to turbulence.

Elected April 20, 1954

GEORGE C. PAFFENBARGER, chief, American Dental Association Fellowship Group, National Bureau of Standards, in recognition of his contributions to physical and chemical properties of dental materials.

Elected June 1, 1954

JOHN R. PELLAM, physicist, Norman Bridge Laboratory, California Institute of Technology, in recognition of his important experimental and theoretical contributions arising from extensive investigations of the properties of liquid helium at low temperatures, specifically the development of the "Thermal Rayleigh Disk" and its successful application in the measurement of intensity and velocity of "second sound" in liquid helium II.

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